Defense Information Systems Agency
Department of Defense

DISA's Transition to Model Based Systems Engineering (MBSE)

Enterprise Engineering Directorate (EE)

Agenda

- Objective
- Improved practices
- Architecting processes
- Benefits of the approach
- DISA’s transition to Model Based Systems Engineering (MBSE)

Objective

- Develop an integrated architecture for critical portions of the GIG
  - Comprehensive
    - Includes all essential capabilities
    - Applies to all DoD Components
  - Based on rigorous Systems Engineering principles
    - Such as those espoused by DoD 5000, INCOSE, etc.
- Traditional development practices have not produced the desired results for complex, large scale IT problems
  - Current artifacts do not routinely address critical analysis details
    - Imprecise descriptions lead to different interpretations of the artifacts
  - Focus is on generating artifacts rather than the underlying data
    - Improved techniques could provide input for better analysis

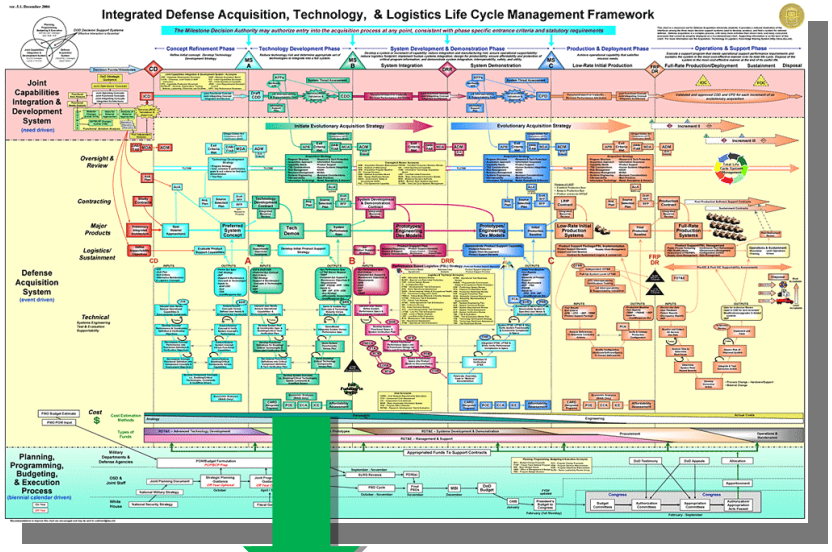
We Need to Understand How Systems Work

Improved Practices

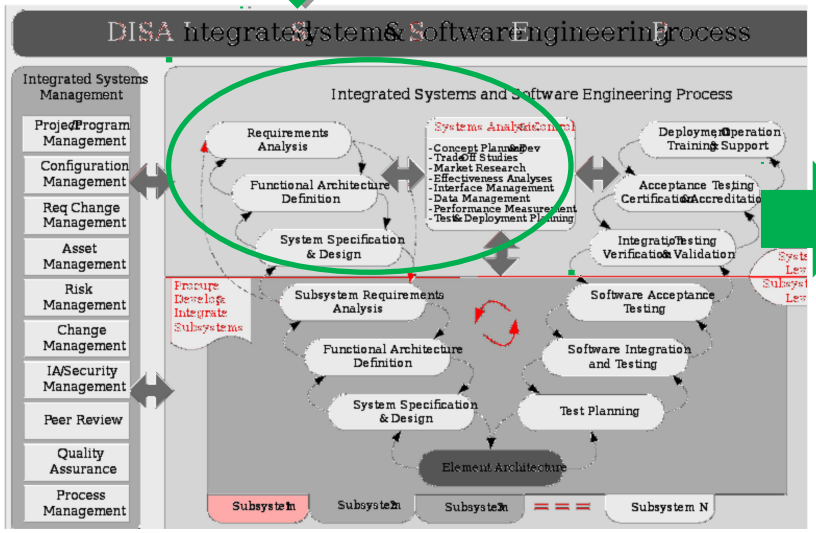
- Adopt Model Based Systems Engineering (MBSE)
  - Use the Object Management Group (OMG) Systems Modeling Language (SysML)
    - Standards based, and therefore tool independent
    - Derived from UML, a mature modeling language
    - Executable (can generate code)
  - Develop models that represent the capabilities
    - Use the models to simulate capabilities
    - Store models in a single, common data structure
  - Enhances our ability to use automation tools to generate standard artifacts from the common data source
    - Consistent with DoDAF 2.0 architecture requirements
    - Can lead to improved system specifications
  - Industry is already moving in this direction

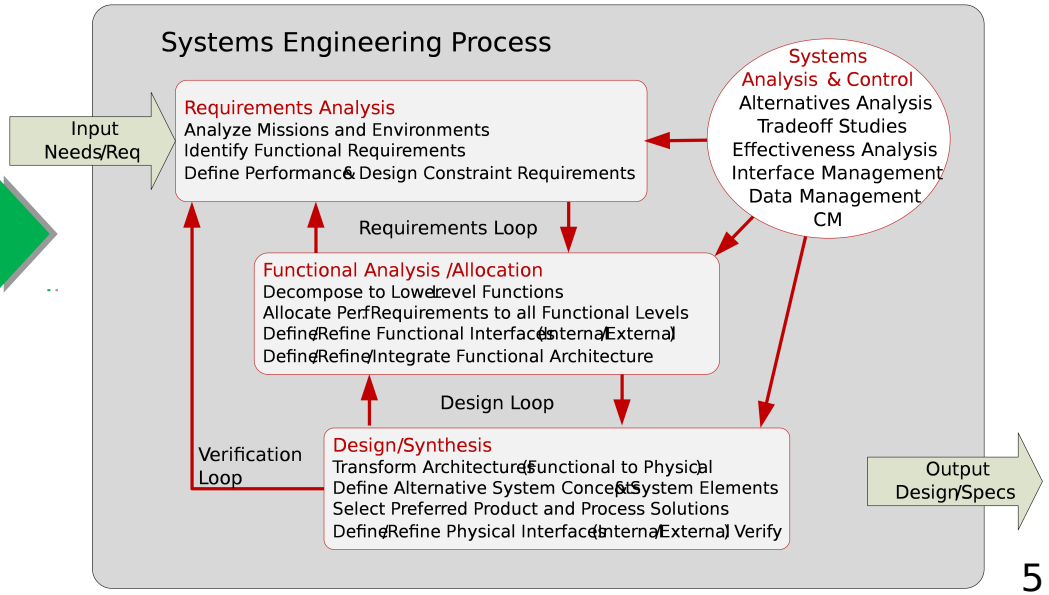
Can Reduce Cost & Improve Performance

The Architecting Process

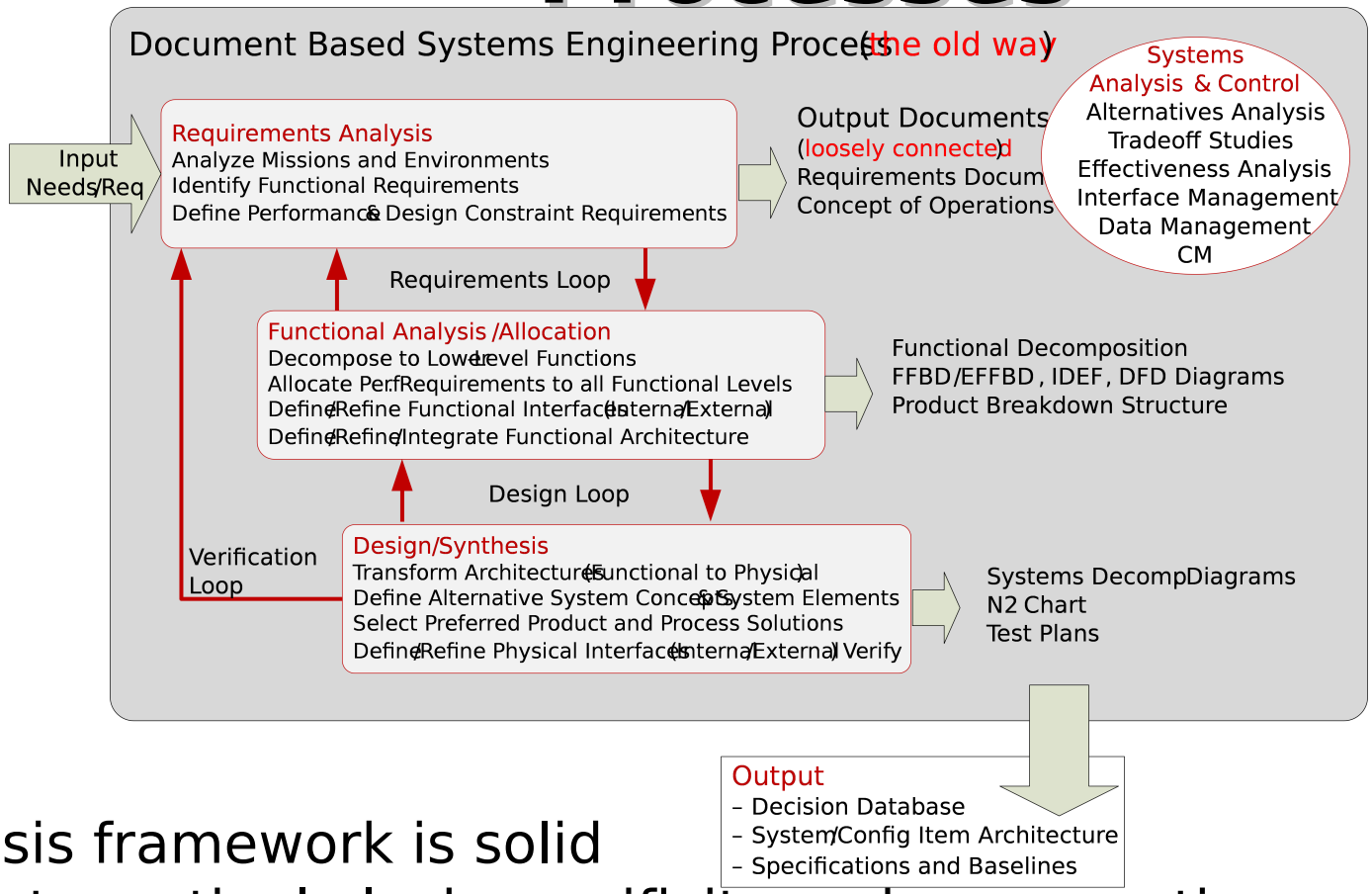

Integrated Defense Acquisition, Technology, & Logistics Life Cycle Management Framework
Joint Capabilities Integration & Development System
Defense Acquisition System
Planning, Programming, Budgeting, & Execution Process

- Derived from the acquisition process (DoD 5000)
- Early part of the Systems Engineering (SE) Process
  - Involves decomposing the problem in order to define a solution
- It is far more cost effective to address issues early in the SE process





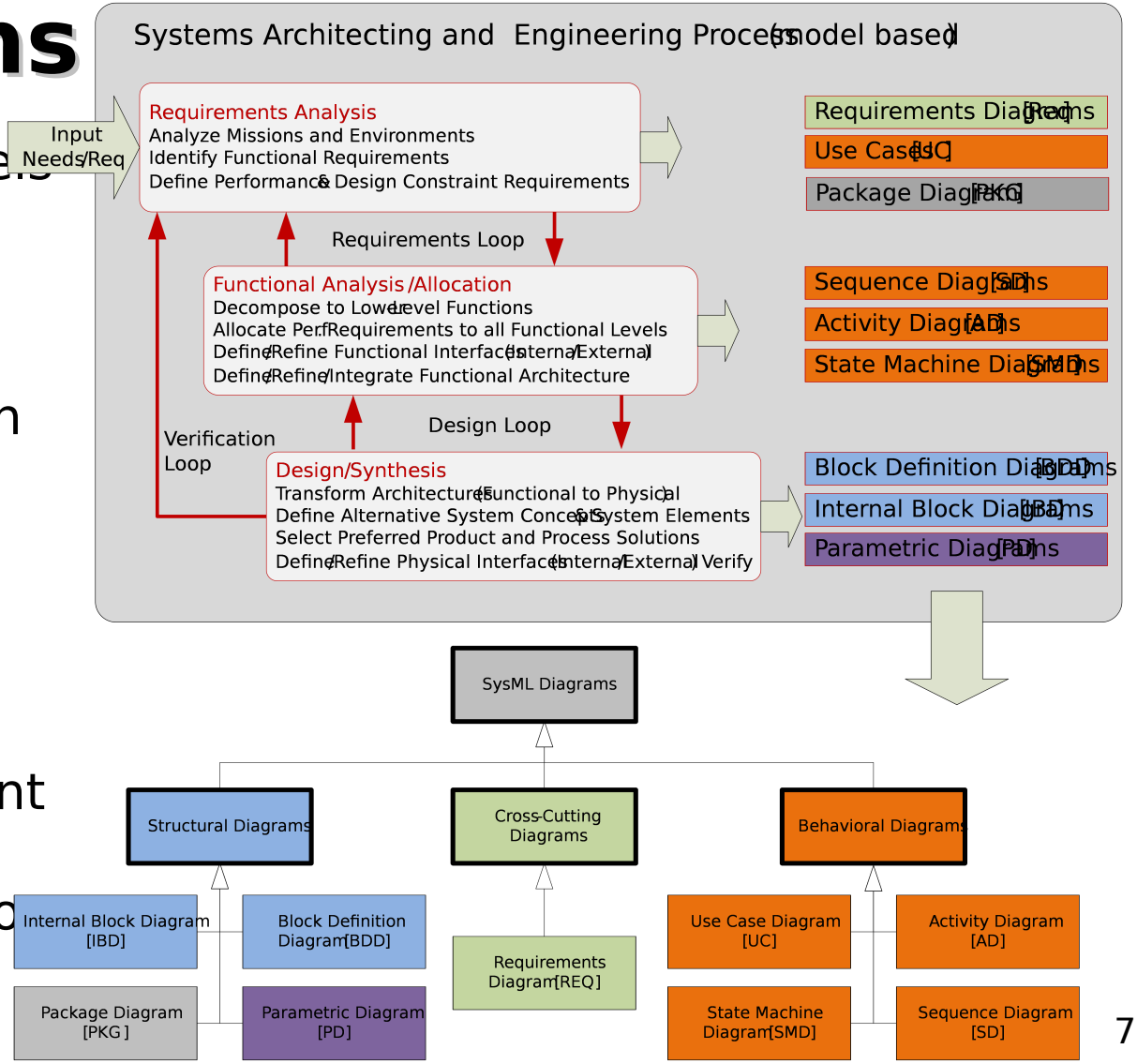
Existing Architecting Processes



- Analysis framework is solid
- Artifacts routinely lack specificity and are sometimes ambiguous, which leads to various interpretations
- Visualizing designs with this approach is labor intensive, which makes it costly to update & synchronize artifacts

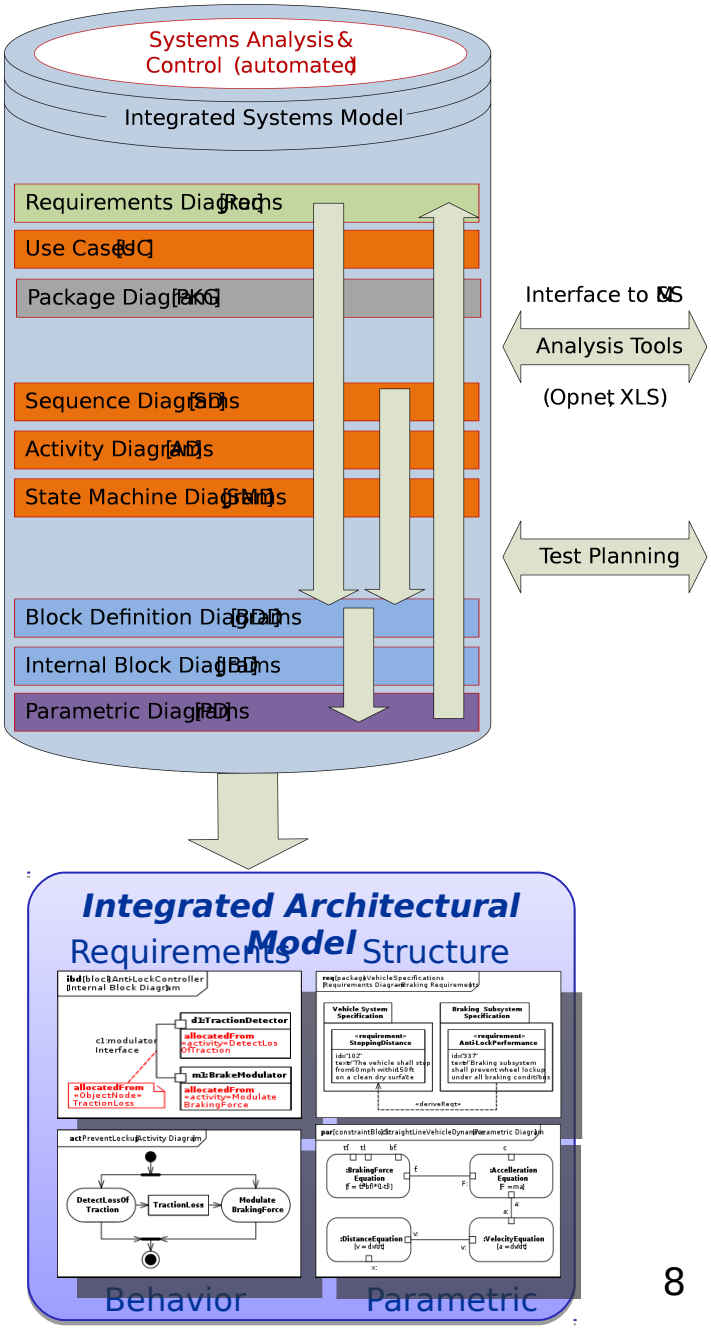
Architecting With Model Based Systems

- Uses the same architecting process
- Creates SysML models rather than developing documents
- Automation tools can be used to generate routine artifacts directly
- SysML provides 9 different types of diagrams to represent the architecture, which can be used to develop solutions
  - 4 behavioral



Benefits of MBSE

- Models use common data sets
  - Provides a consistent view of the architecture
  - Can lead directly to system specifications & test plans
  - Reduces systems integration and testing risks
  - Promotes traceability
  - Makes it possible to identify gaps and overlaps
  - Facilitates model reuse and integration
- Uses a standards based modeling language
  - Defines architectures that can be simulated with standard tools
  - Models can be used with many standards compliant automation tools
- Automation tools are used to generate artifacts
  - Less labor intensive to generate & update



DISA's Transition to MBSE

- Actions to date
  - Training the Enterprise Engineering staff
  - Updating our internal processes
  - Developing a common data structure so that models representing individual capabilities can be integrated
  - Developed a standard template with 9 standard SysML artifact types for documenting DISA capabilities
  - Piloting the process by producing models & SysML artifacts for some select capabilities in the FY11 GIG Convergence Master Plan (GCMP)
- Planned actions
  - Transition remaining DISA program/project capabilities
  - Update future versions of the GCMP with SysML artifacts
  - Continue training DISA & DoD personnel
  - Develop all new capabilities using MBSE

Summary

- Benefits of the MBSE approach
  - Models use common data sets
  - Uses a standards based modeling language
  - Automation tools are used to generate artifacts
- Expected result
  - Reduce technical documentation & lower cost
- We will be including some early piloting of this MBSE approach in the FY11 GCMP

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Example of Architecture for Wireless Capabilitie

Capabilities

Handheld Wireless Devices	Voice	Data	Mobile Satellite Comm.	Mobile Wireless Comm.
Access DISN Services via commercial cellular products w/ DoD security feature set	Connect to DoD voice gateway for multilevel Secure Voice Service	Connect to SIPRNET for Data Services	Extend DISN Services to tactical users via satellite communications	Extend DISN Services to tactical users via wireless communications

Services

Secure Mobile Services for Smart Phones

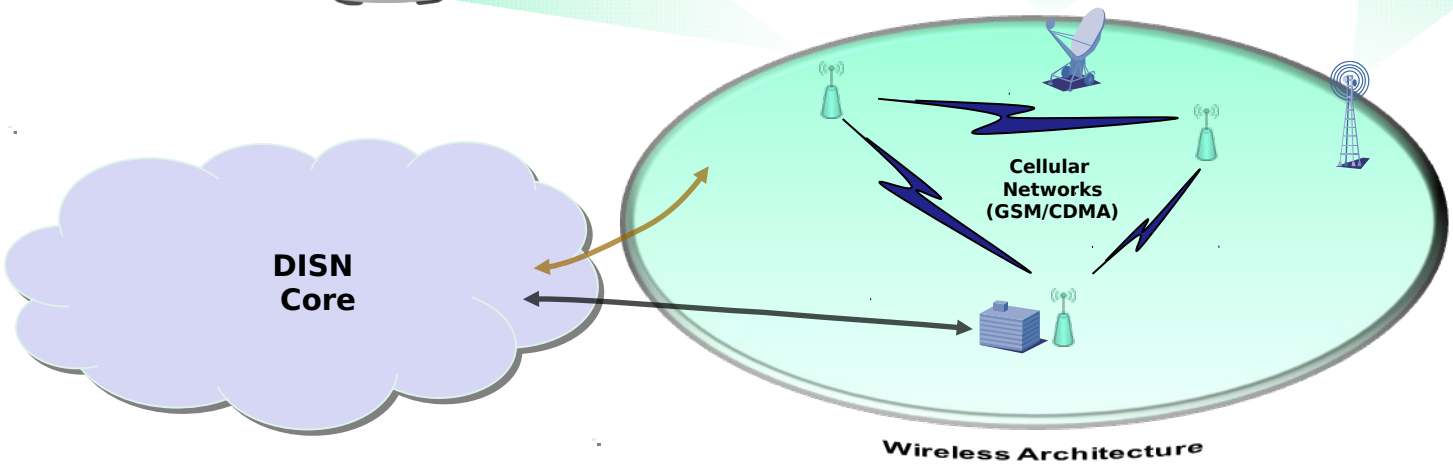
Does Not work under water

Iridium

wimax

Wireless Extension

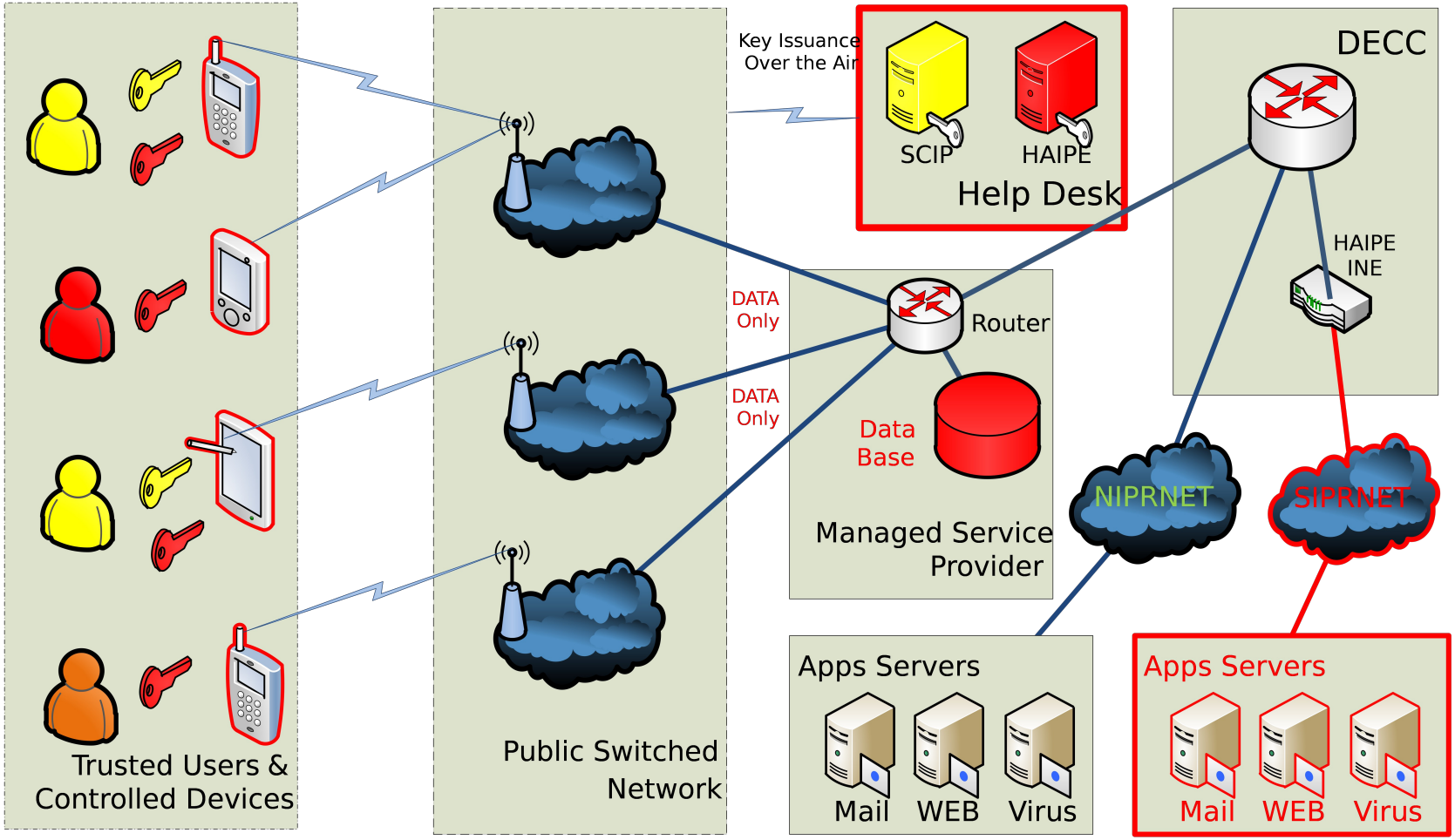
Infrastructure

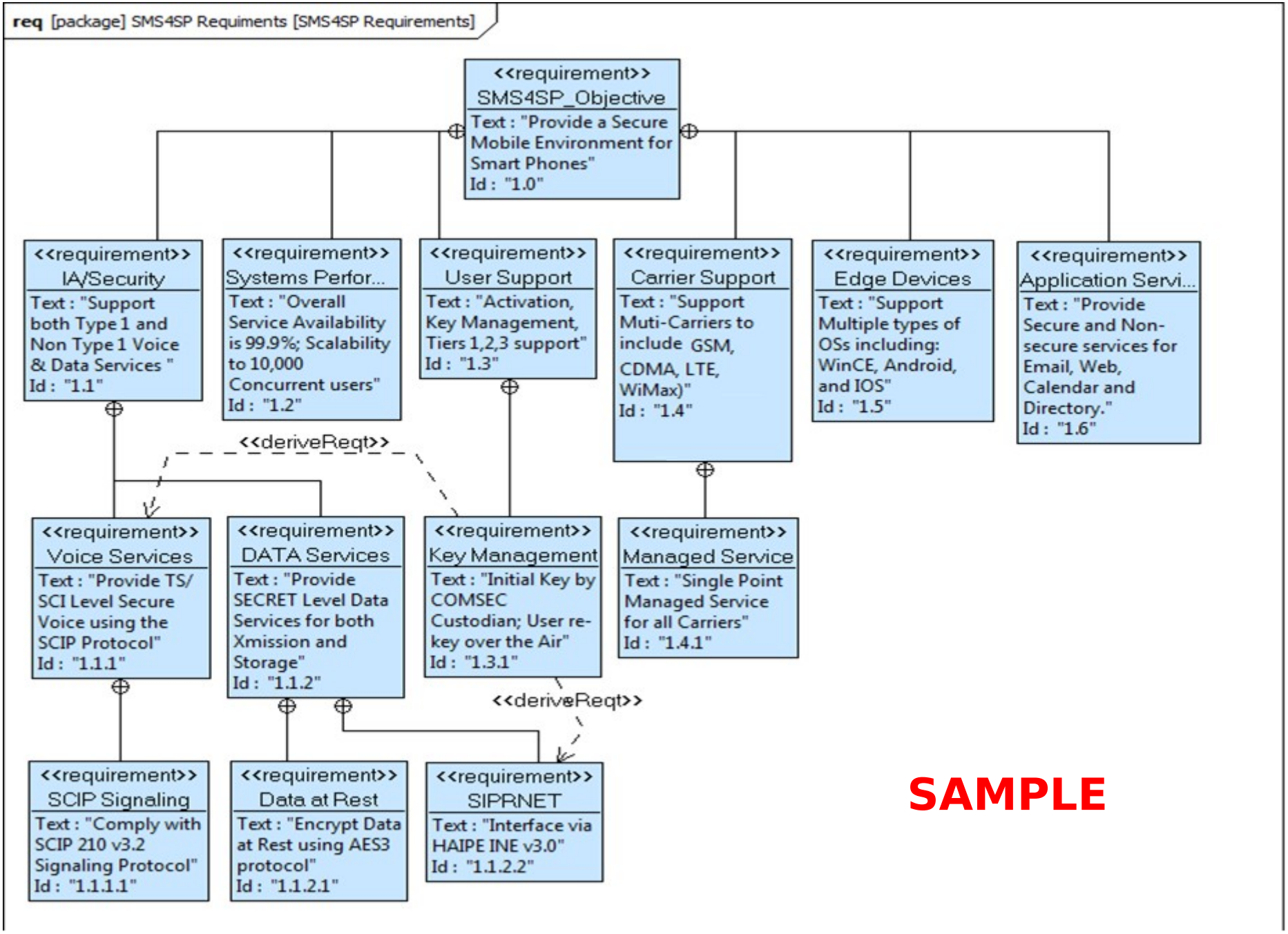


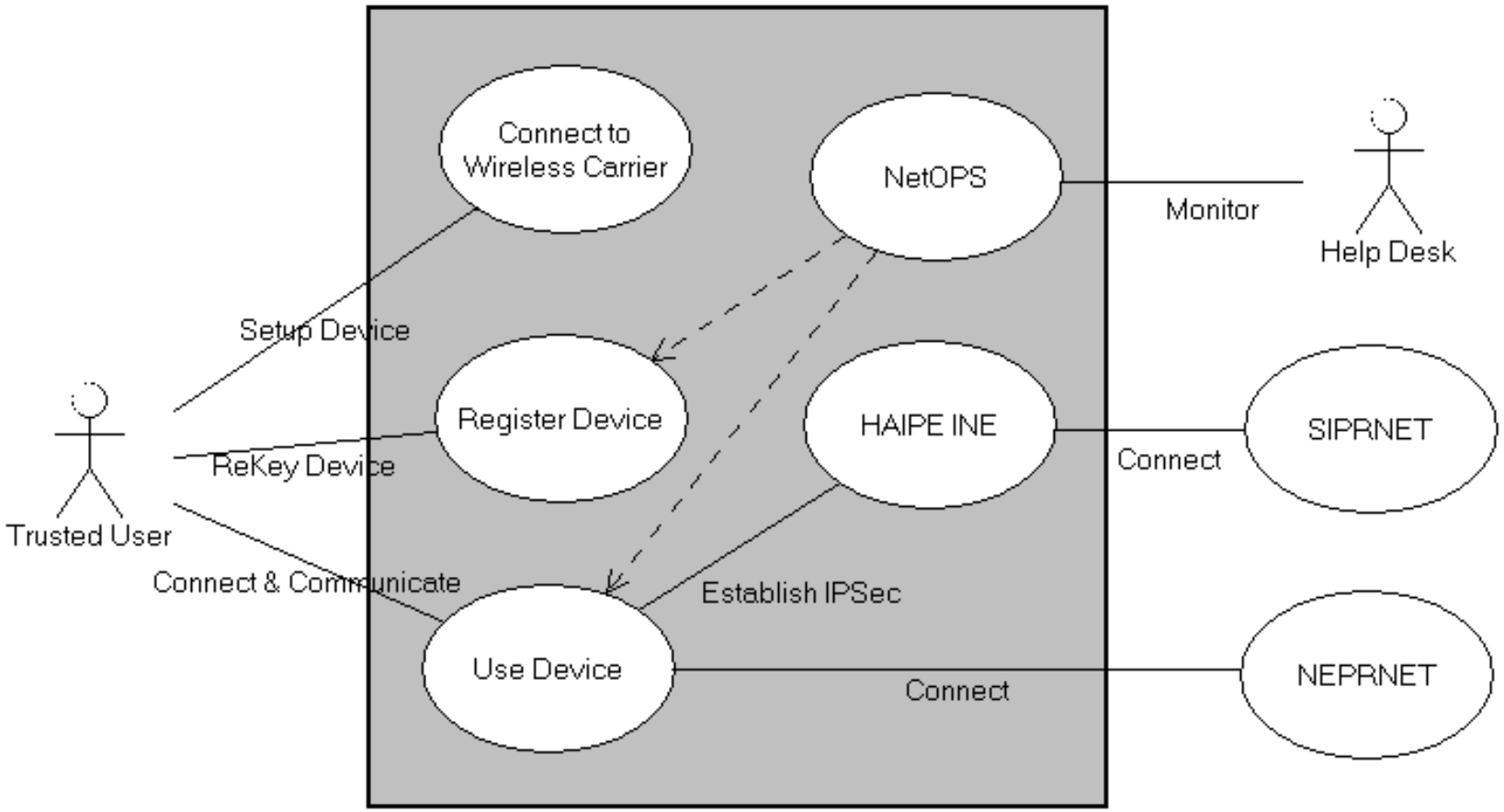
Application/Data Layer: Web Services, Content Repositories

Seamless and Secure Wireless Communication Services

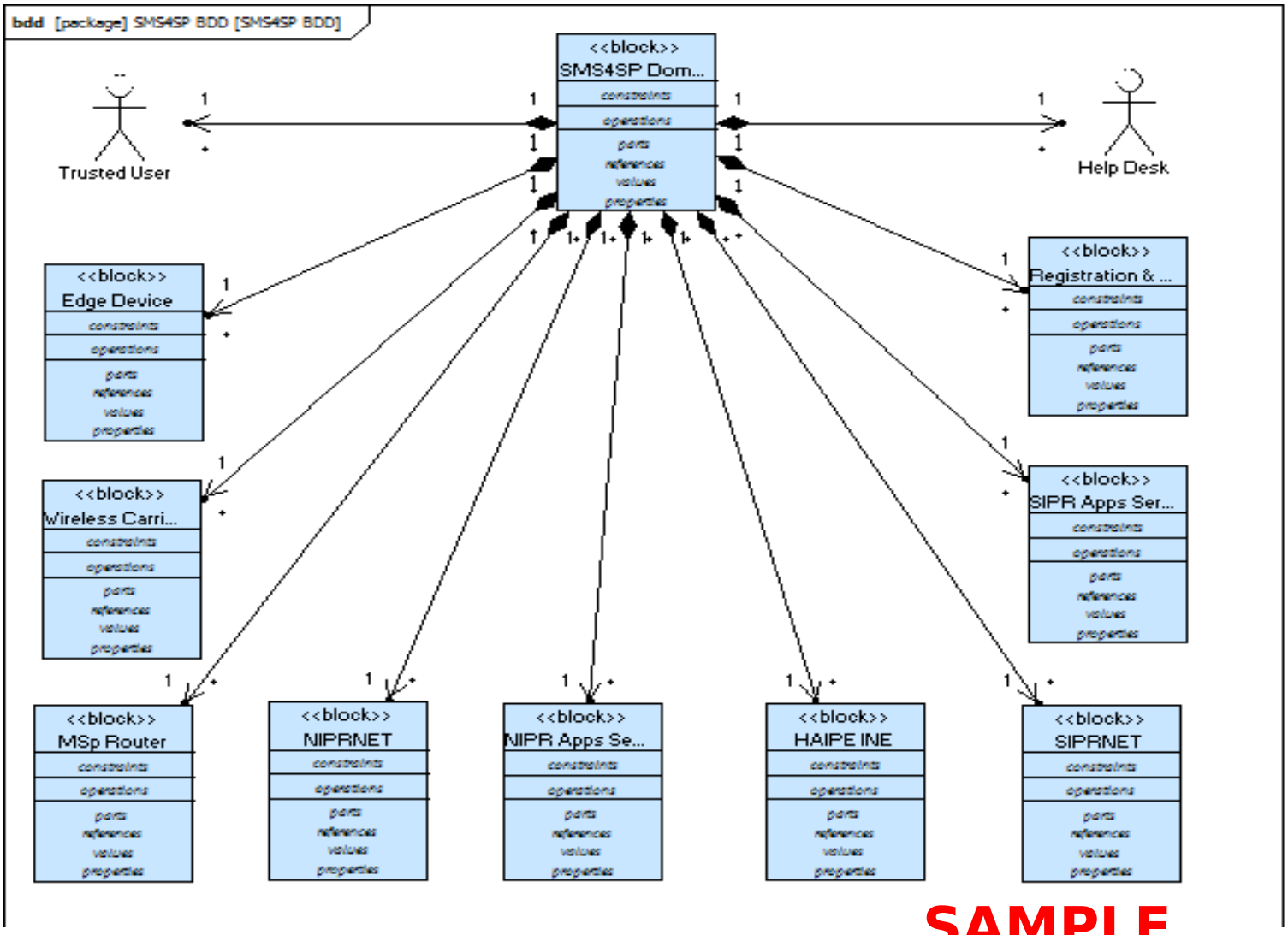
OV1 for SMS4SP




req [package] SMS4SP Requiments [SMS4SP Requirements]
<<requirement>>
SMS4SP_Objective
Text : "Provide a Secure Mobile Environment for Smart Phones"
Id : "1.0"
<<requirement>>
IA/Security
Text : "Support both Type 1 and Non Type 1 Voice & Data Services "
Id : "1.1"
<<requirement>>
Systems Perfor...
Text : "Overall Service Availability is 99.9%; Scalability to 10,000 Concurrent users"
Id : "1.2"
<<requirement>>
User Support
Text : "Activation, Key Management, Tiers 1,2,3 support"
Id : "1.3"
<<requirement>>
Carrier Support
Text : "Support Muti-Carriers to include GSM, CDMA, LTE, WiMax)"
Id : "1.4"
<<requirement>>
Edge Devices
Text : "Support Multiple types of OSs including: WinCE, Android, and IOS"
Id : "1.5"
<<requirement>>
Application Servi...
Text : "Provide Secure and Non-secure services for Email, Web, Calendar and Directory."
Id : "1.6"
<<deriveReqt>>
<<requirement>>
Voice Services
Text : "Provide TS/SCI Level Secure Voice using the SCIP Protocol"
Id : "1.1.1"
<<requirement>>
DATA Services
Text : "Provide SECRET Level Data Services for both Xmission and Storage"
Id : "1.1.2"
<<requirement>>
Key Management
Text : "Initial Key by COMSEC Custodian; User re-key over the Air"
Id : "1.3.1"
<<requirement>>
Managed Service
Text : "Single Point Managed Service for all Carriers"
Id : "1.4.1"
<<deriveReqt>>
<<requirement>>
SCIP Signaling
Text : "Comply with SCIP 210 v3.2 Signaling Protocol"
Id : "1.1.1.1"
<<requirement>>
Data at Rest
Text : "Encrypt Data at Rest using AES3 protocol"
Id : "1.1.2.1"
<<requirement>>
SIPRNET
Text : "Interface via HAIPE INE v3.0"
Id : "1.1.2.2"
SAMPLE


package SMS4SP UC
Connect to Wireless Carrier
NetOPS
Monitor
Help Desk
Setup Device
Register Device
HAIPE INE
SIPRNET
Connect
ReKey Device
Trusted User
Connect & Communicate
Establish IPSec
Use Device
NEPRNET
Connect

SAMPLE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constraints
operations
parts
references
values
properties
Trusted User
Help Desk
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Edge Device
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Wireless Carri...
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Registration & ...
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SIPR Apps Ser...
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MSp Router
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NIPRNET
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NIPR Apps Se...
<<block>>
HAIPE INE
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SIPRNET
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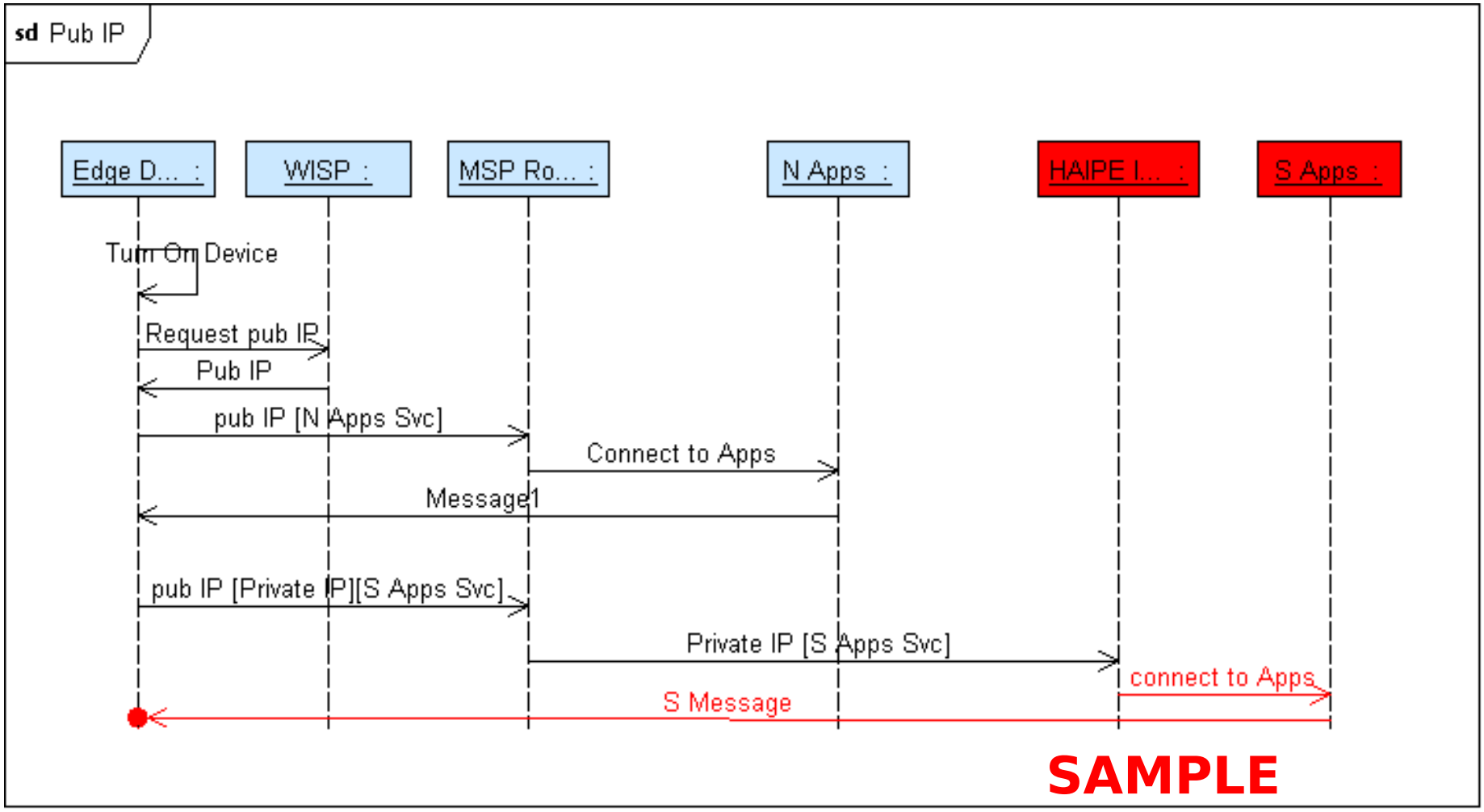
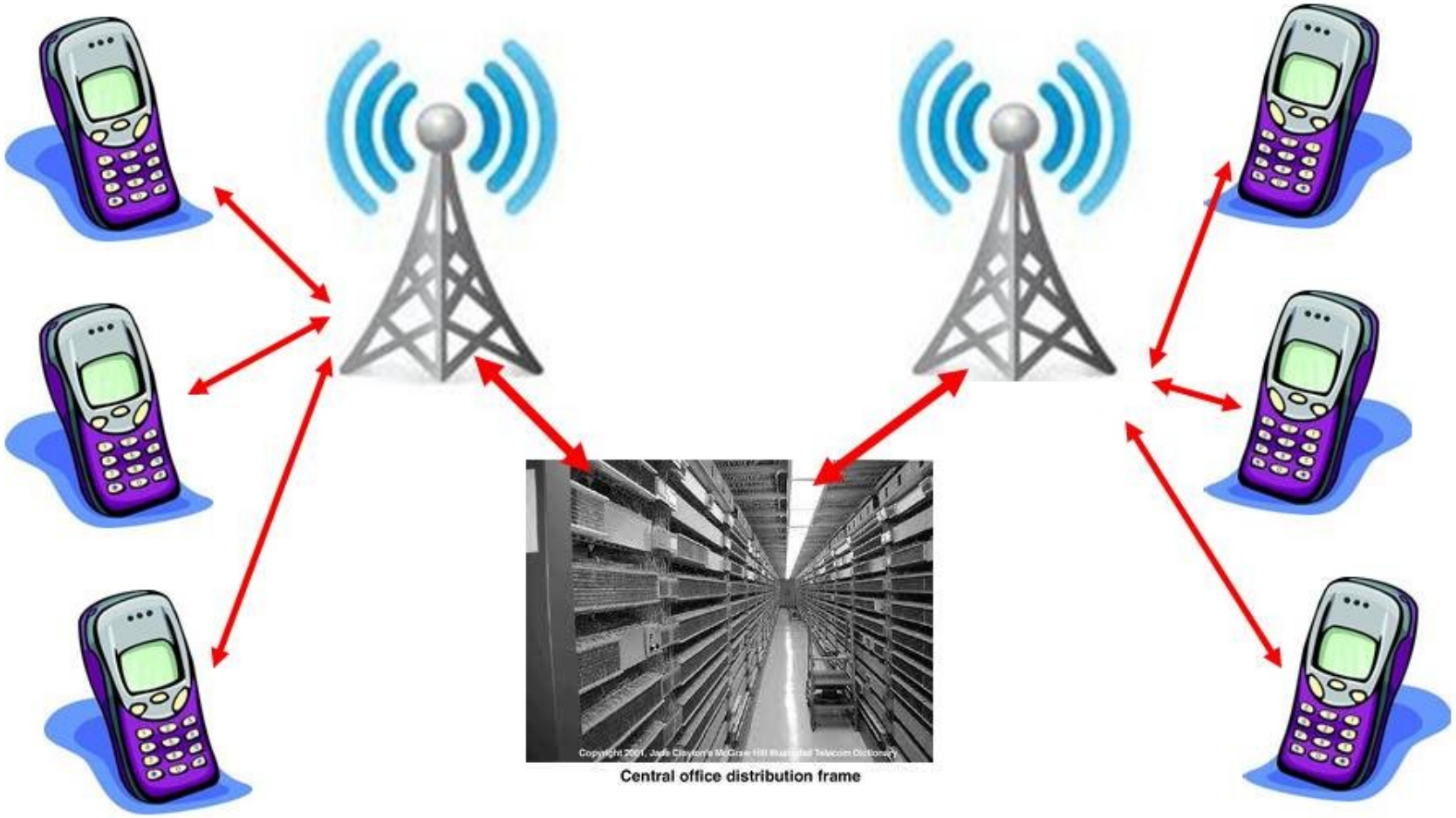

sd Pub IP
Edge D... :
WISP :
MSP Ro... :
N Apps :
HAIPE I... :
S Apps :
Turn On Device
Request pub IP
Pub IP
pub IP [N Apps Svc]
Connect to Apps
Message1
pub IP [Private IP][S Apps Svc]
Private IP [S Apps Svc]
connect to Apps
S Message
SAMPLE

GSM Example



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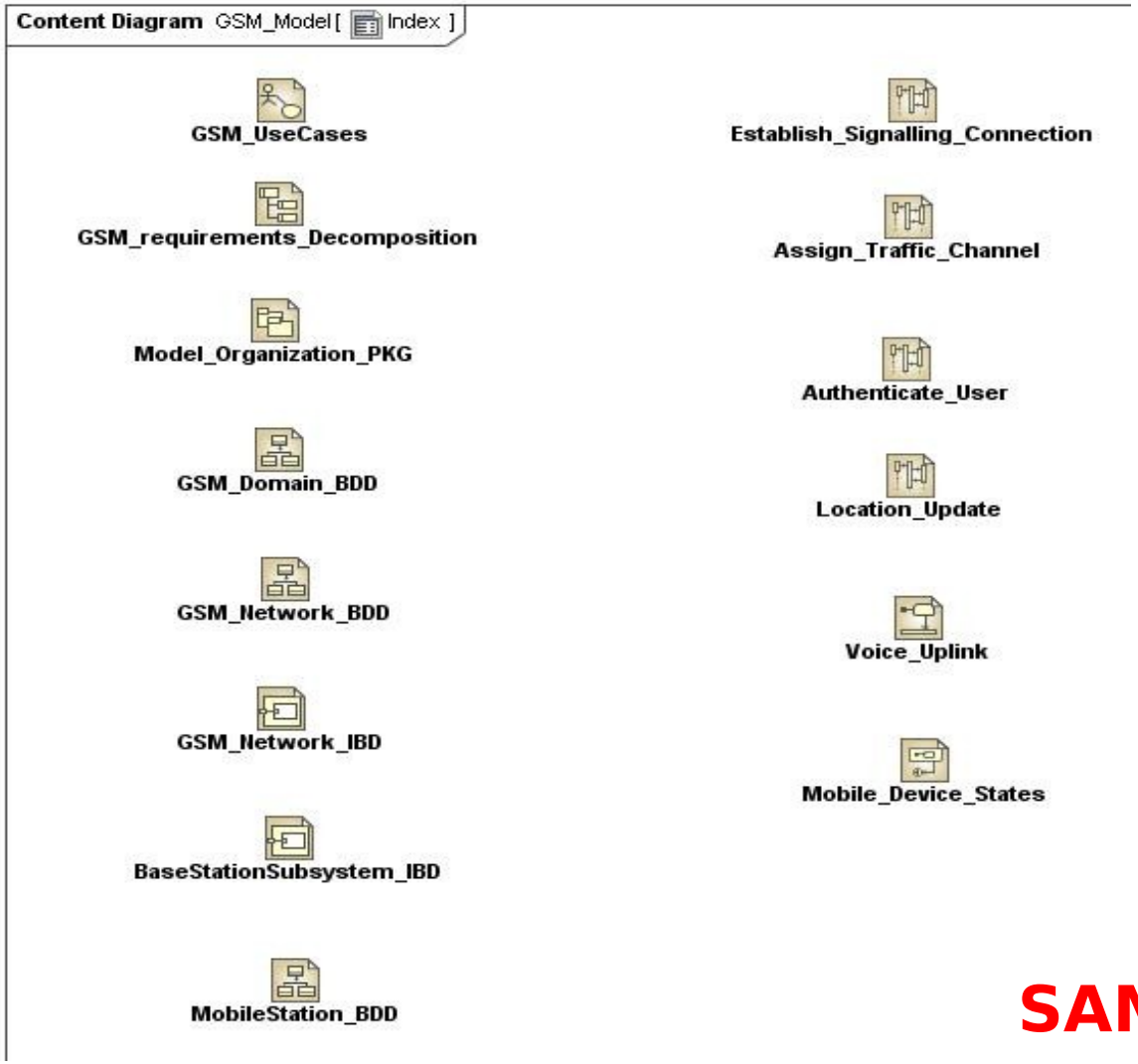
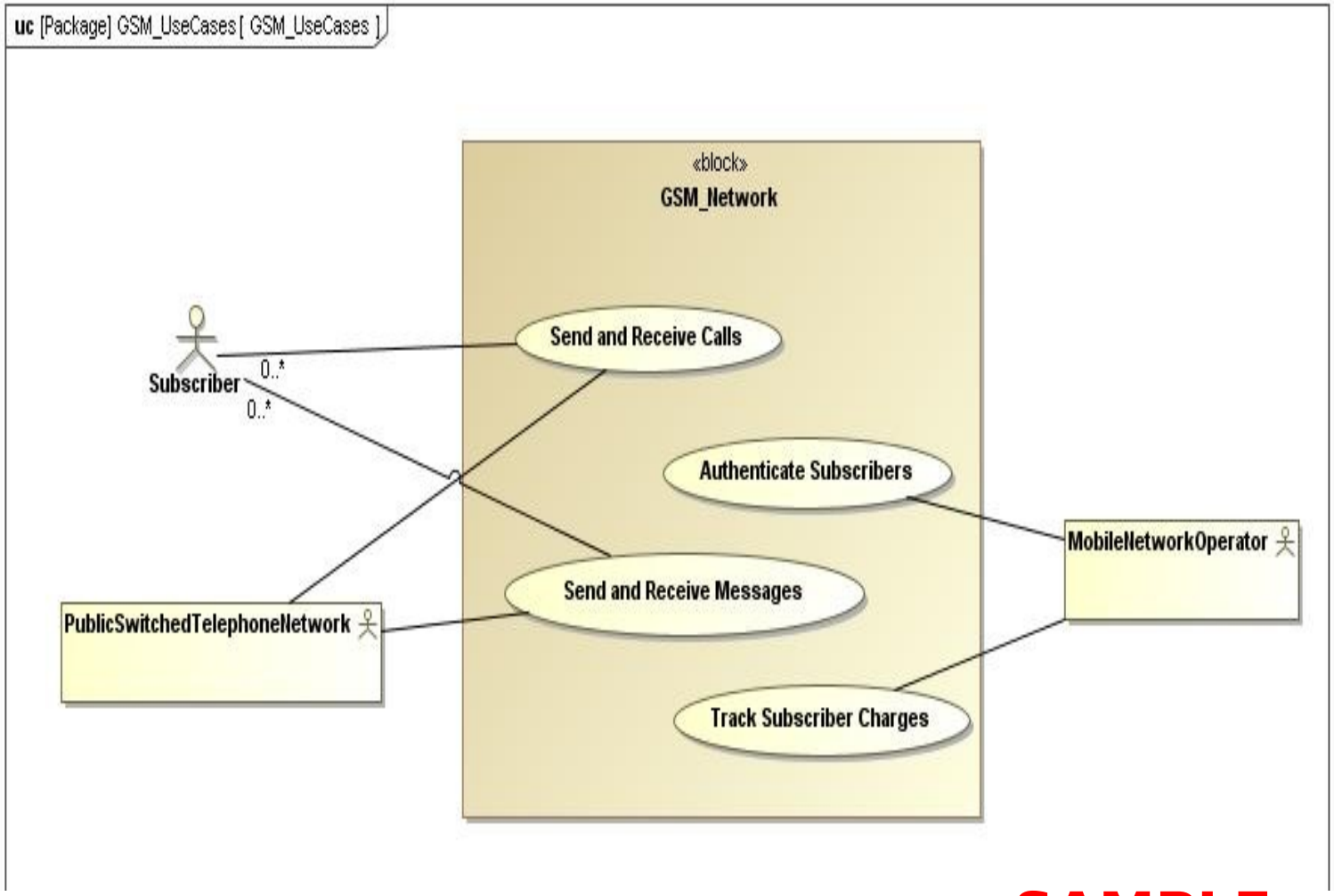


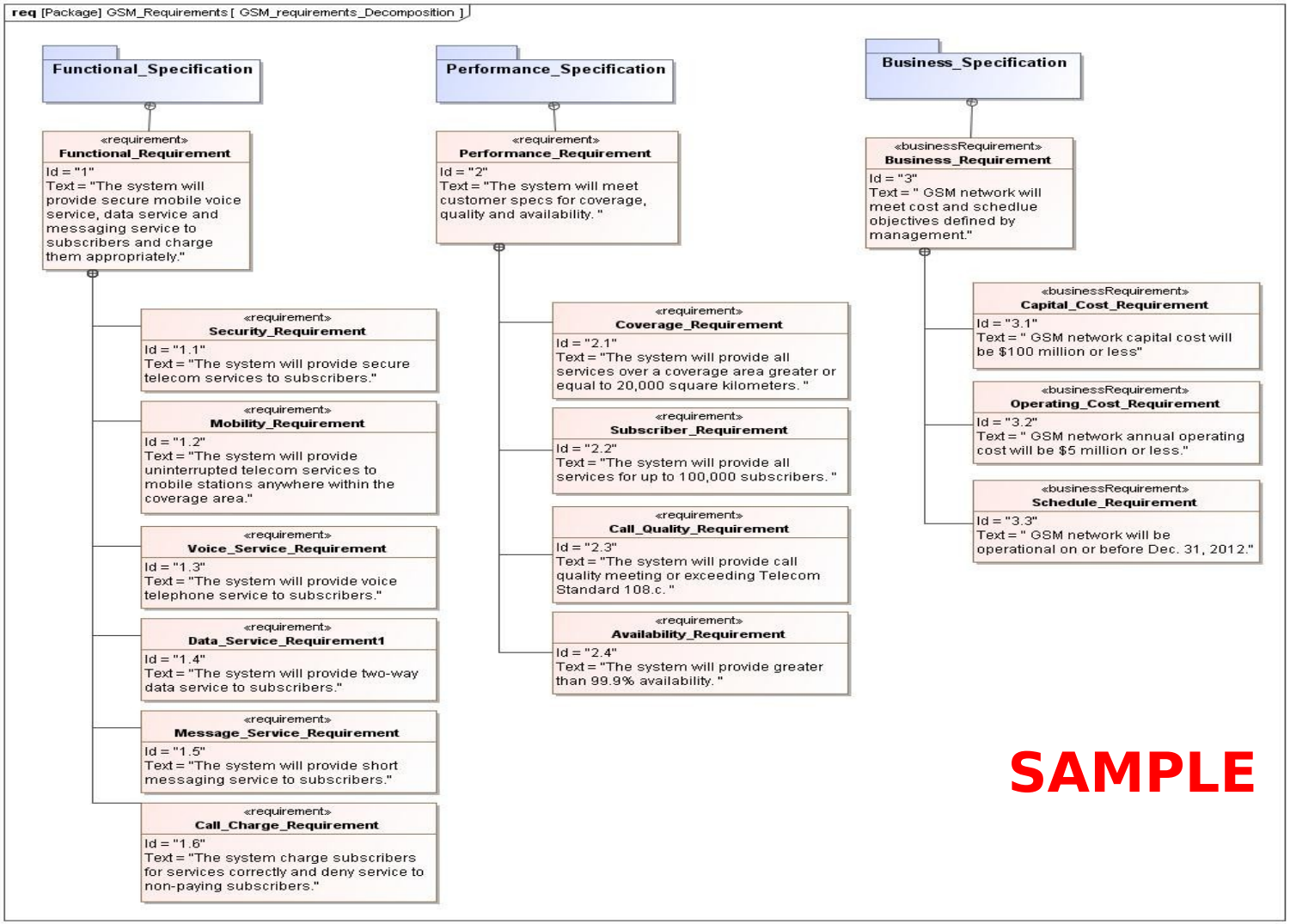
SAMPLE

GSM - UseCases Diagram



SAMPLE

GSM - Requirements Diagram


req [Package] GSM_Requirements [GSM_requirements_Decomposition]
Functional_Specification
«requirement»
Functional_Requirement
Id = "1"
Text = "The system will provide secure mobile voice service, data service and messaging service to subscribers and charge them appropriately."
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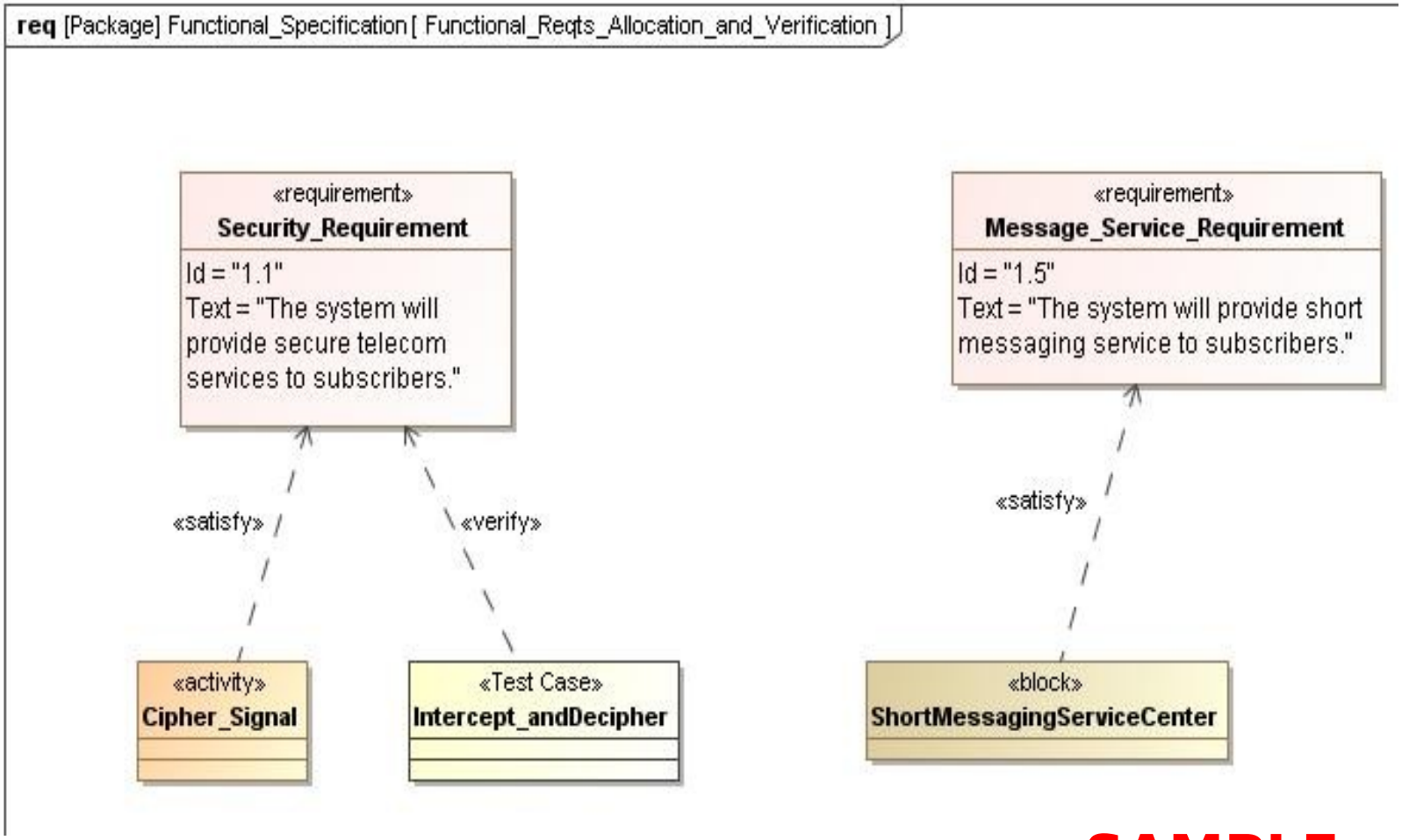
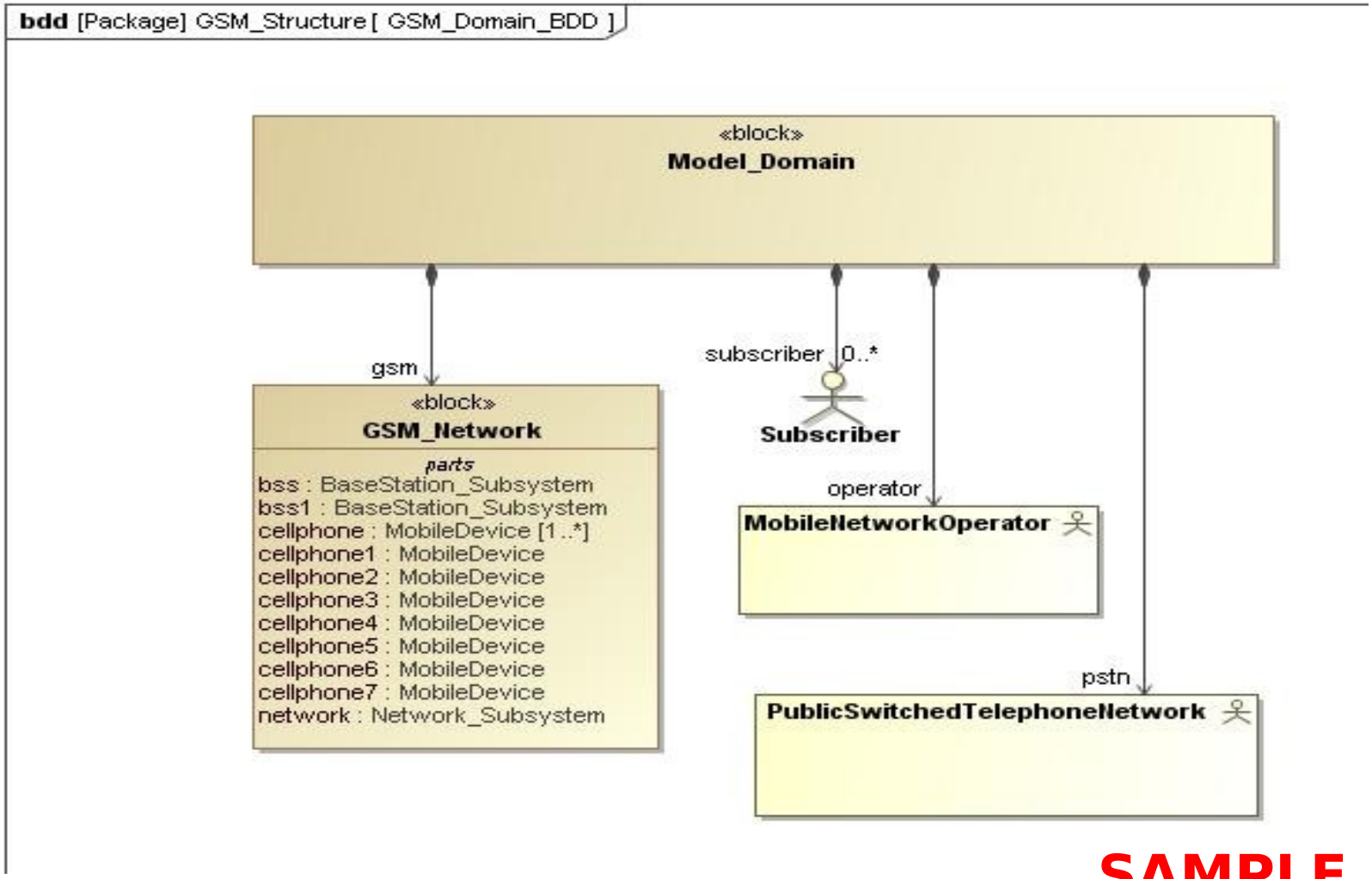
Security_Requirement
Id = "1.1"
Text = "The system will provide secure telecom services to subscribers."
«requirement»
Mobility_Requirement
Id = "1.2"
Text = "The system will provide uninterrupted telecom services to mobile stations anywhere within the coverage area."
«requirement»
Voice_Service_Requirement
Id = "1.3"
Text = "The system will provide voice telephone service to subscribers."
«requirement»
Data_Service_Requirement1
Id = "1.4"
Text = "The system will provide two-way data service to subscribers."
«requirement»
Message_Service_Requirement
Id = "1.5"
Text = "The system will provide short messaging service to subscribers."
«requirement»
Call_Charge_Requirement
Id = "1.6"
Text = "The system charge subscribers for services correctly and deny service to non-paying subscribers."
Performance_Specification
«requirement»
Performance_Requirement
Id = "2"
Text = "The system will meet customer specs for coverage, quality and availability. "
«requirement»
Coverage_Requirement
Id = "2.1"
Text = "The system will provide all services over a coverage area greater or equal to 20,000 square kilometers. "
«requirement»
Subscriber_Requirement
Id = "2.2"
Text = "The system will provide all services for up to 100,000 subscribers. "
«requirement»
Call_Quality_Requirement
Id = "2.3"
Text = "The system will provide call quality meeting or exceeding Telecom Standard 108.c. "
«requirement»
Availability_Requirement
Id = "2.4"
Text = "The system will provide greater than 99.9% availability. "
Business_Specification
«businessRequirement»
Business_Requirement
Id = "3"
Text = " GSM network will meet cost and schedlue objectives defined by management."
«businessRequirement»
Capital_Cost_Requirement
Id = "3.1"
Text = " GSM network capital cost will be $100 million or less"
«businessRequirement»
Operating_Cost_Requirement
Id = "3.2"
Text = " GSM network annual operating cost will be $5 million or less."
«businessRequirement»
Schedule_Requirement
Id = "3.3"
Text = " GSM network will be operational on or before Dec. 31, 2012."
SAMPLE

Functional_Reqts_Allocation_and_Verification



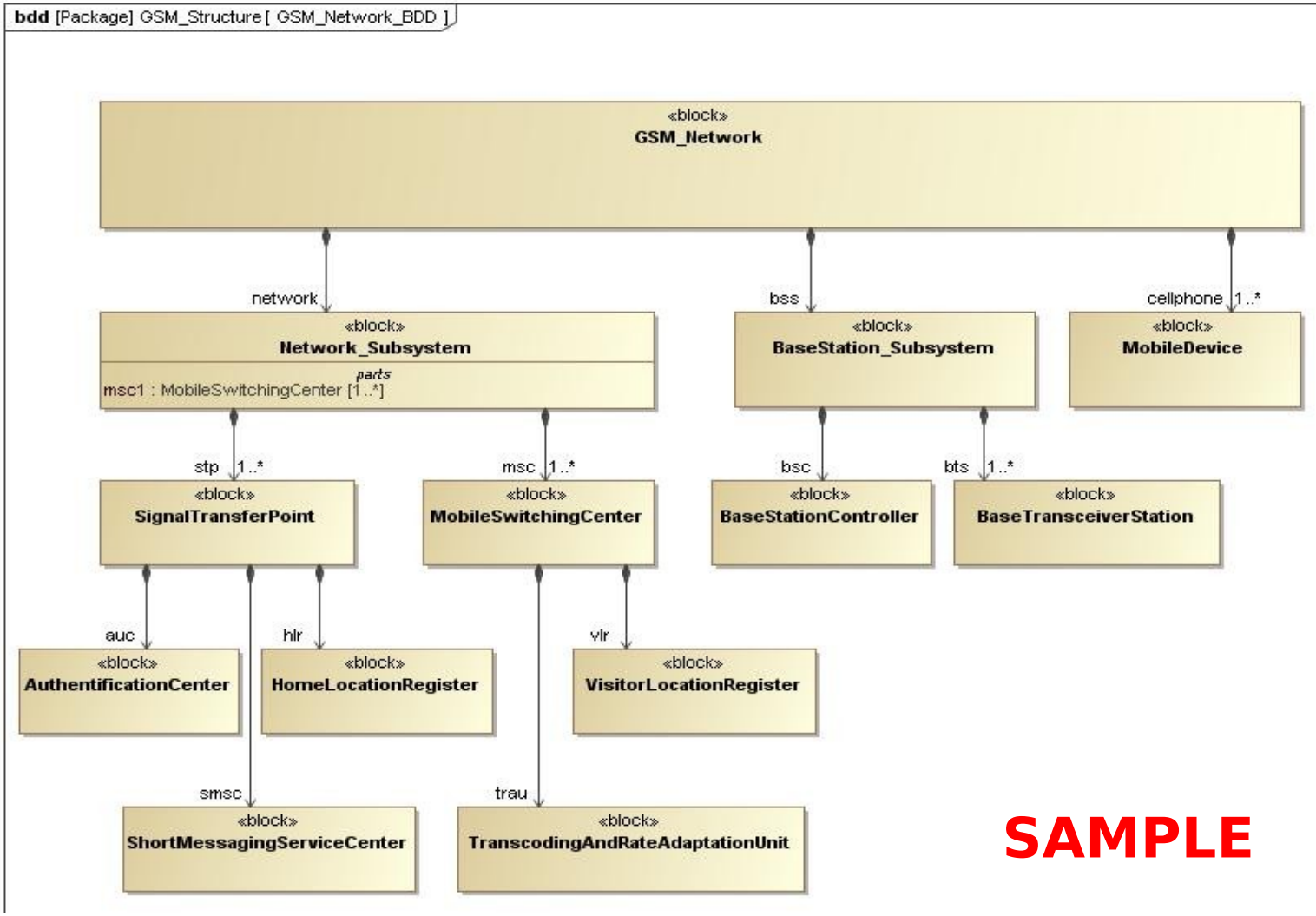
SAMPLE

GSM_Domain - Block Definition Diagram



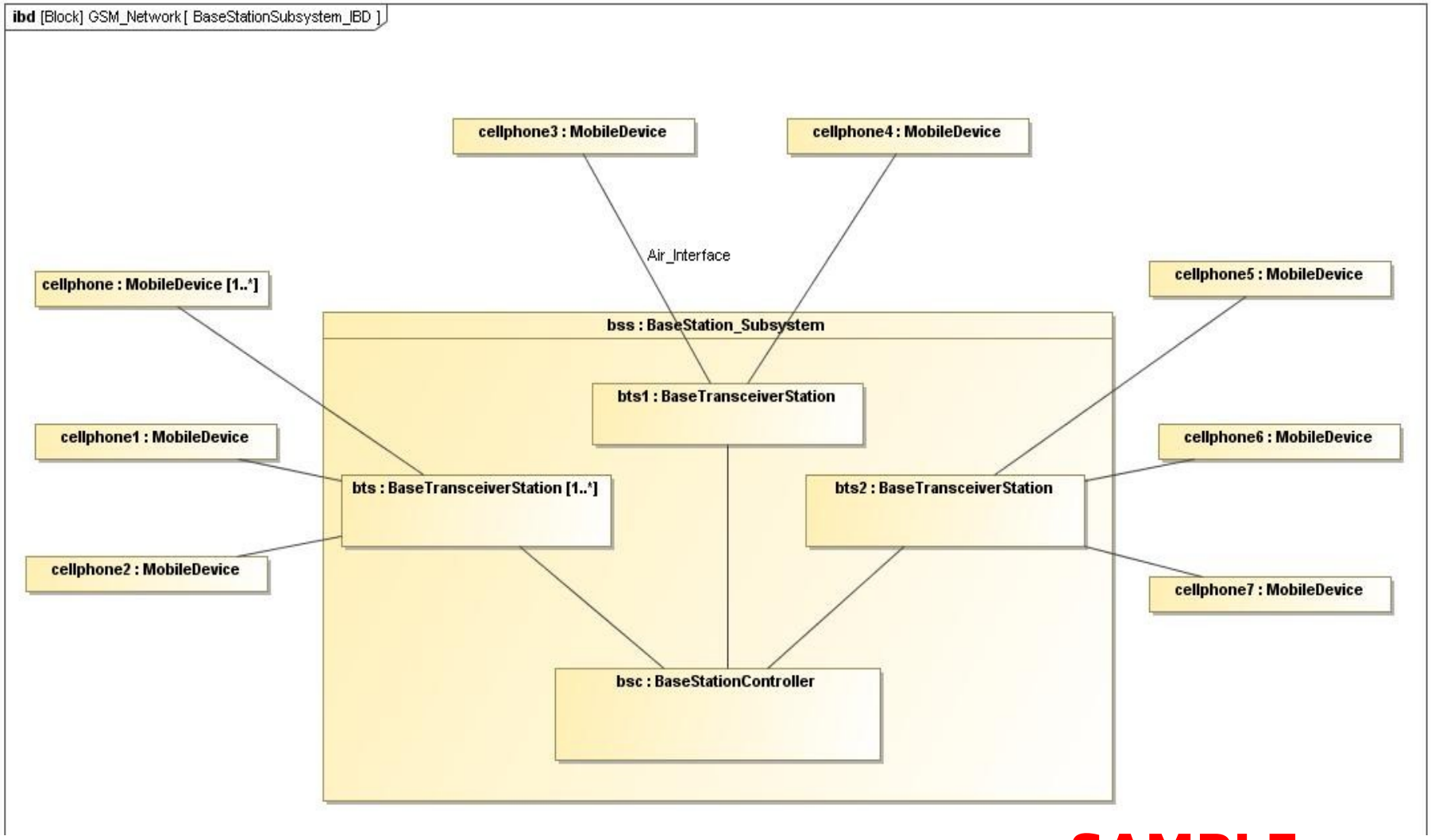
SAMPLE

GSM_Network - Block Definition Diagram



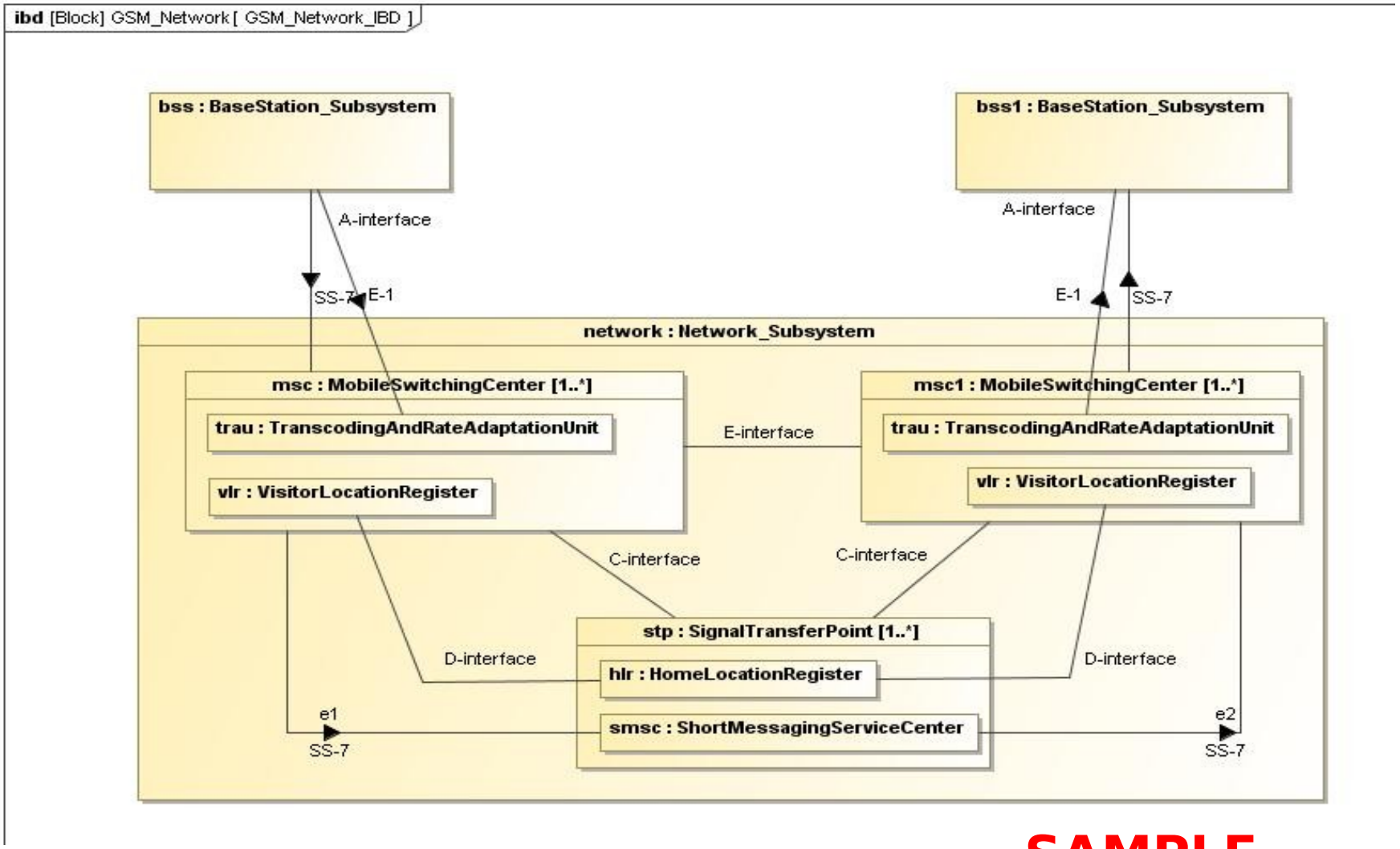
SAMPLE

BaseStationSubsystem - Internal Block Diagram



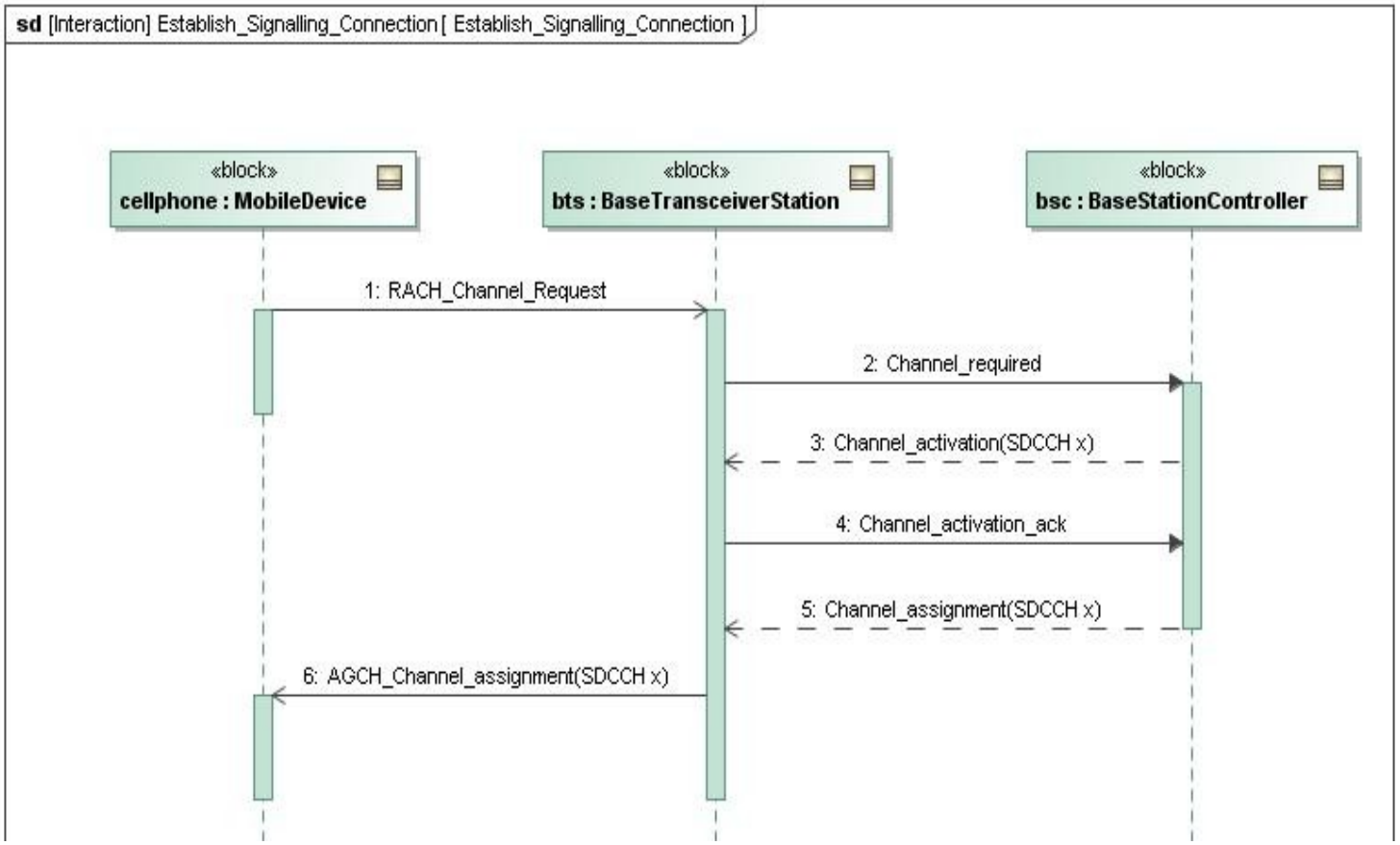
SAMPLE

GSM_Network – Internal Block Diagram



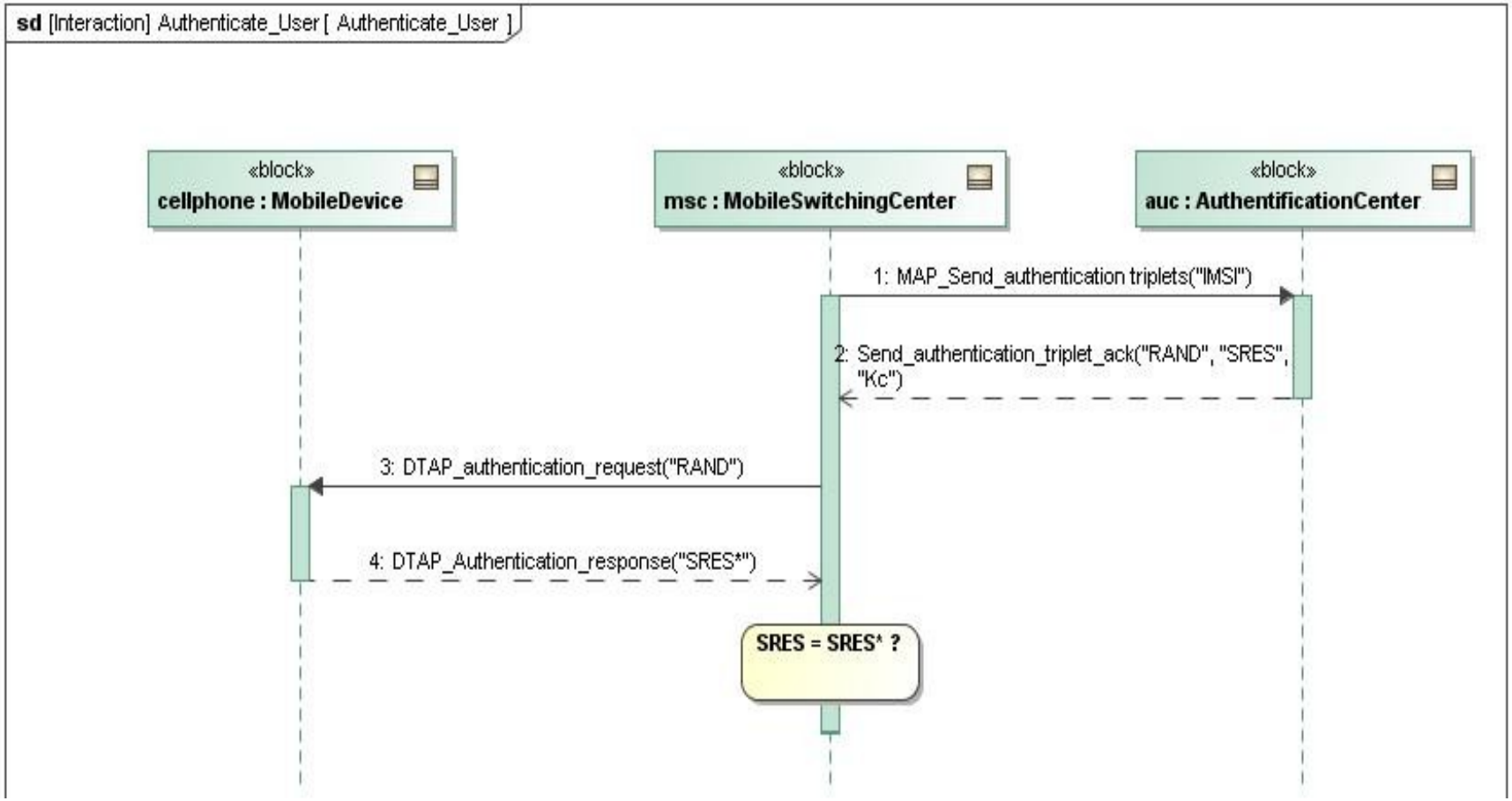
SAMPLE

Establish_Signalling_Connection



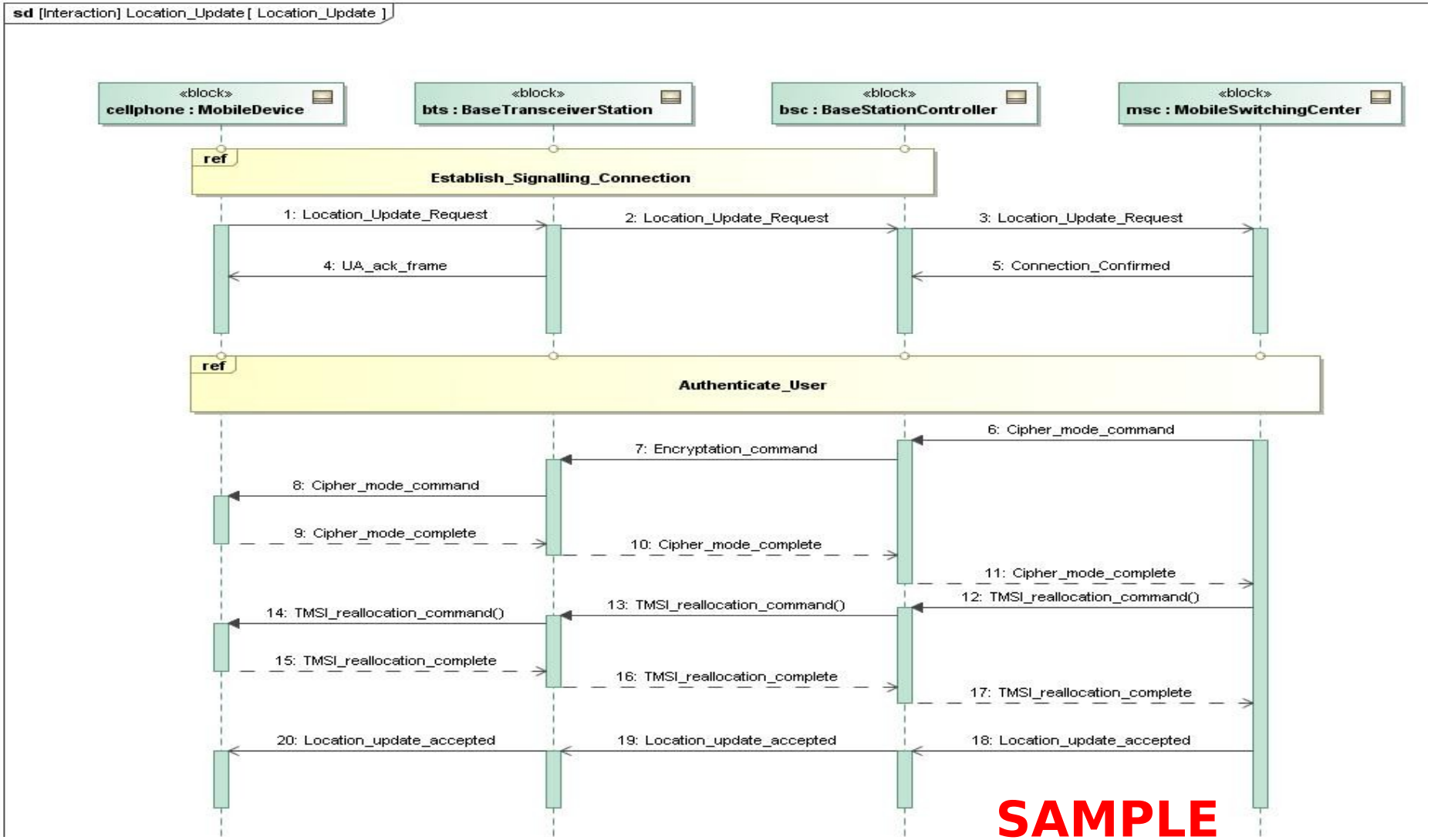
SAMPLE

Authenticate_



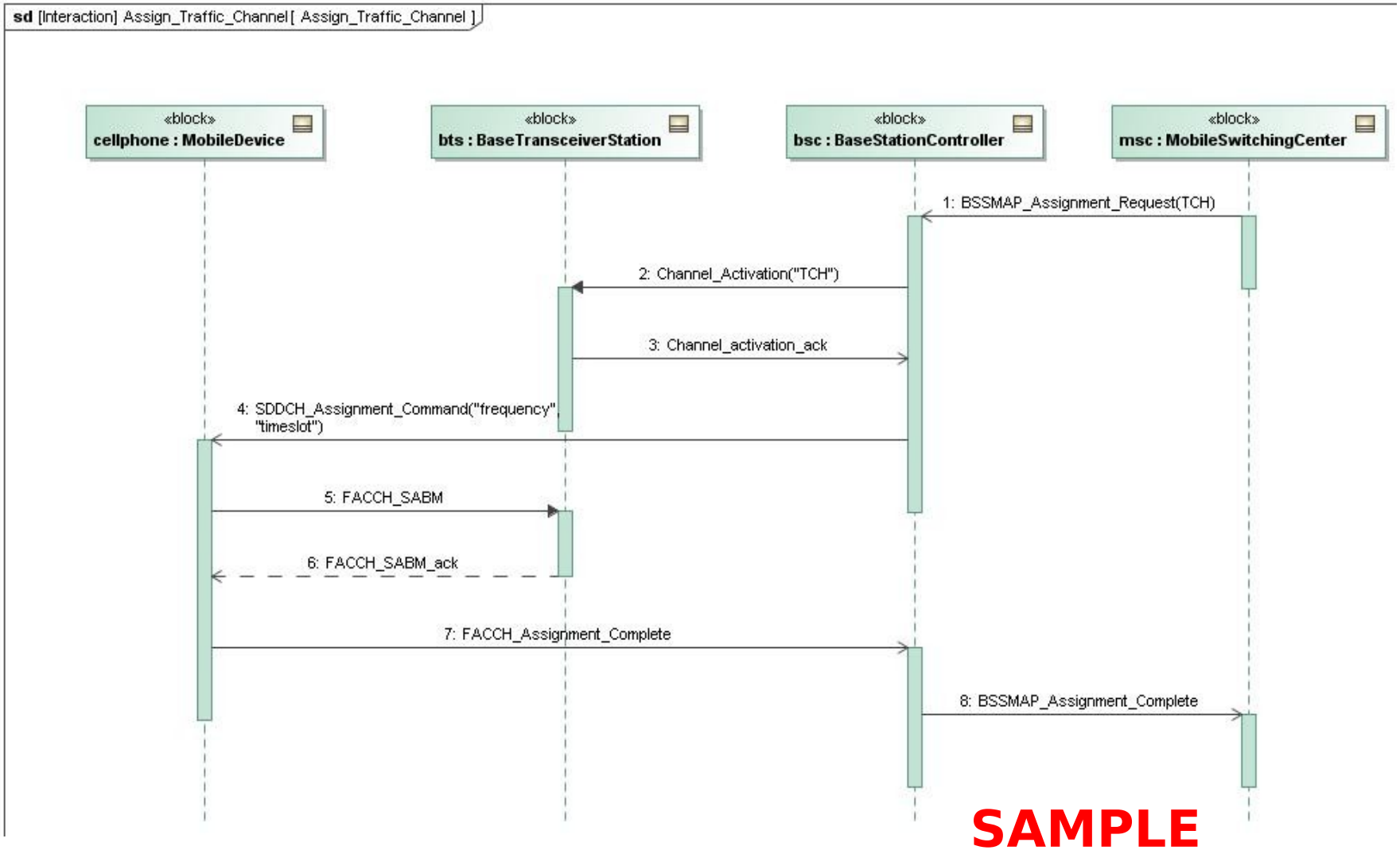
SAMPLE

Location_Upda



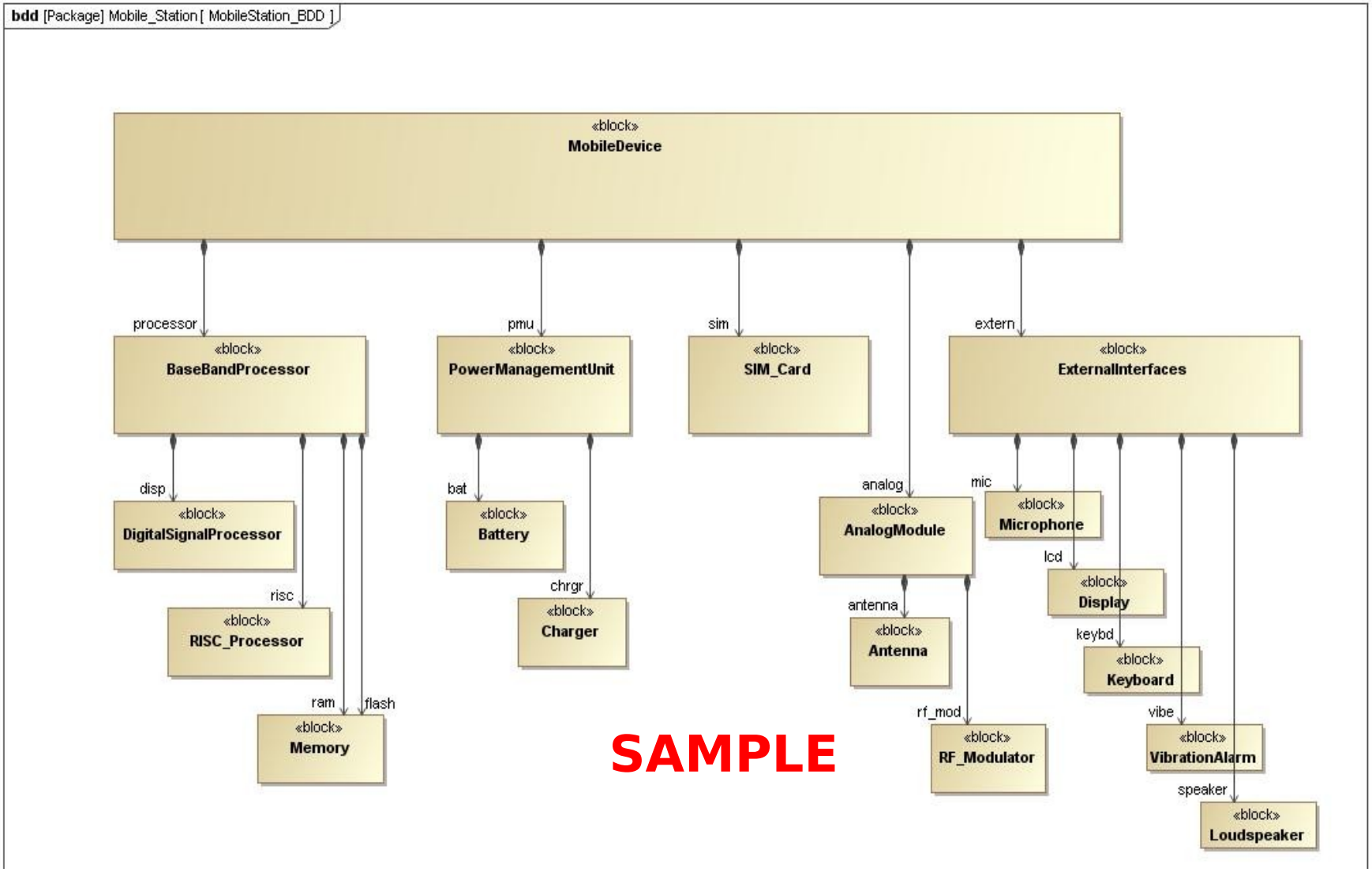
SAMPLE

Assign_Traffic_Chann

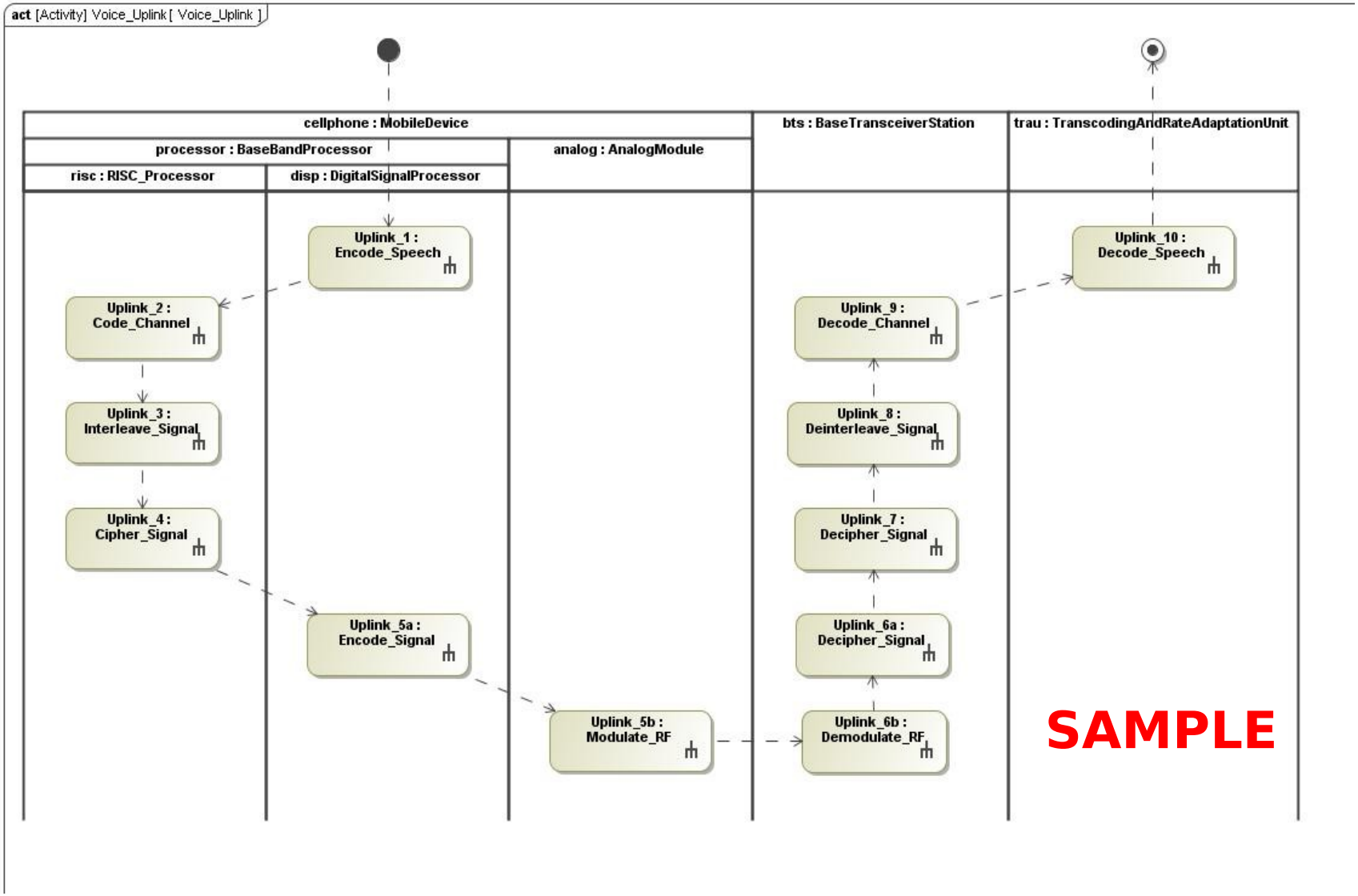


SAMPLE

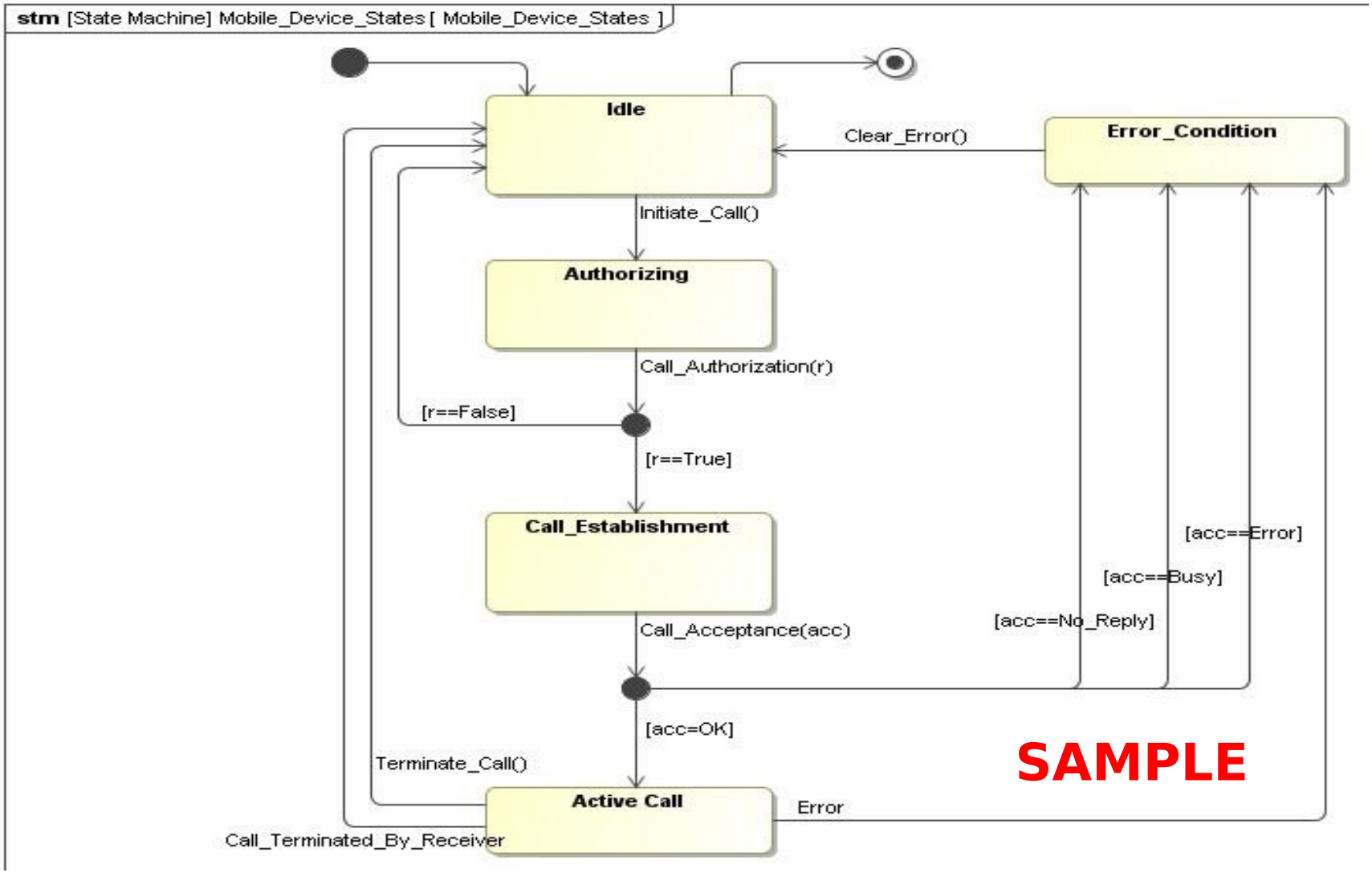
MobileStation_



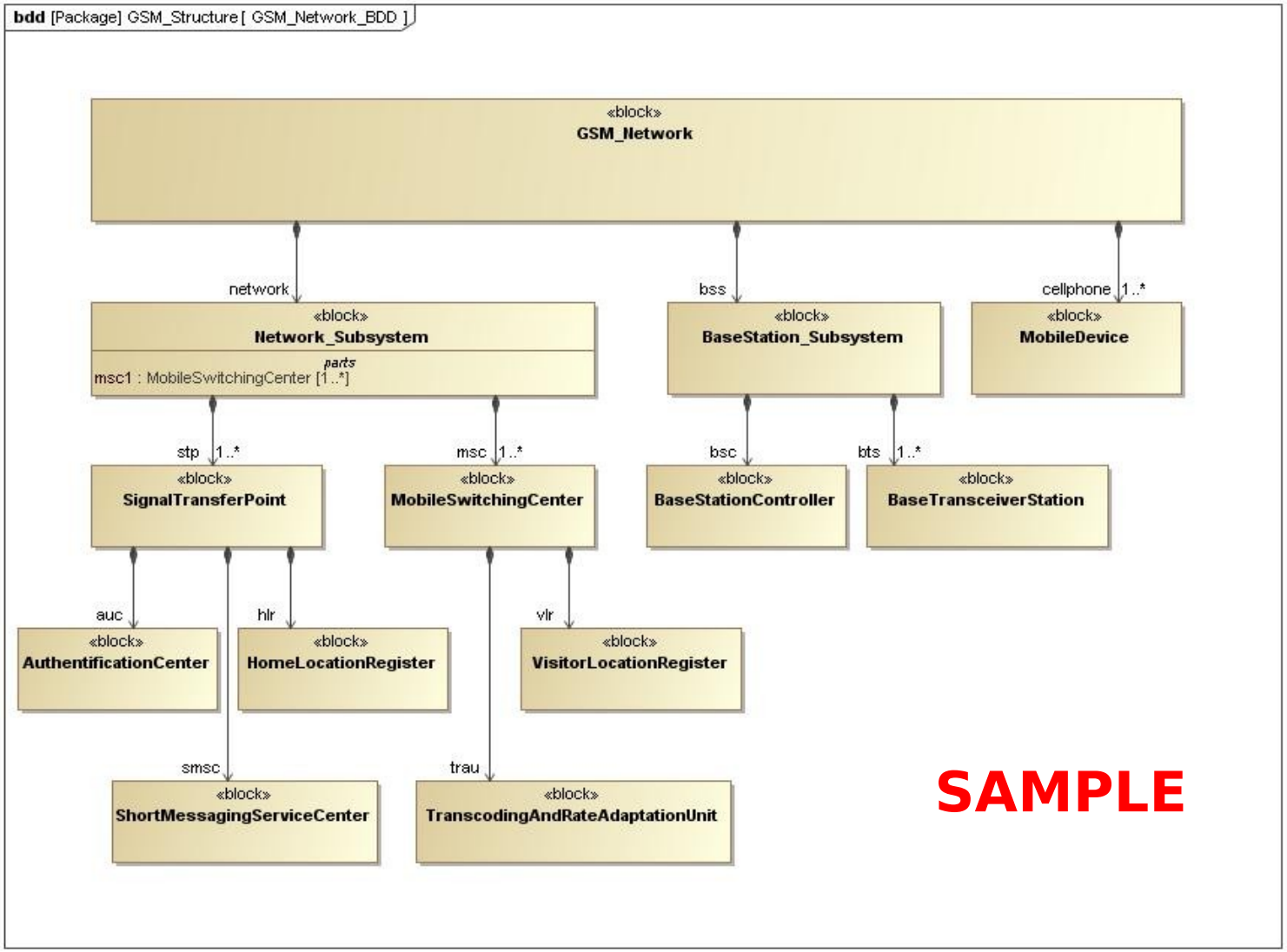
Voice_Uplink – Activity Diagram



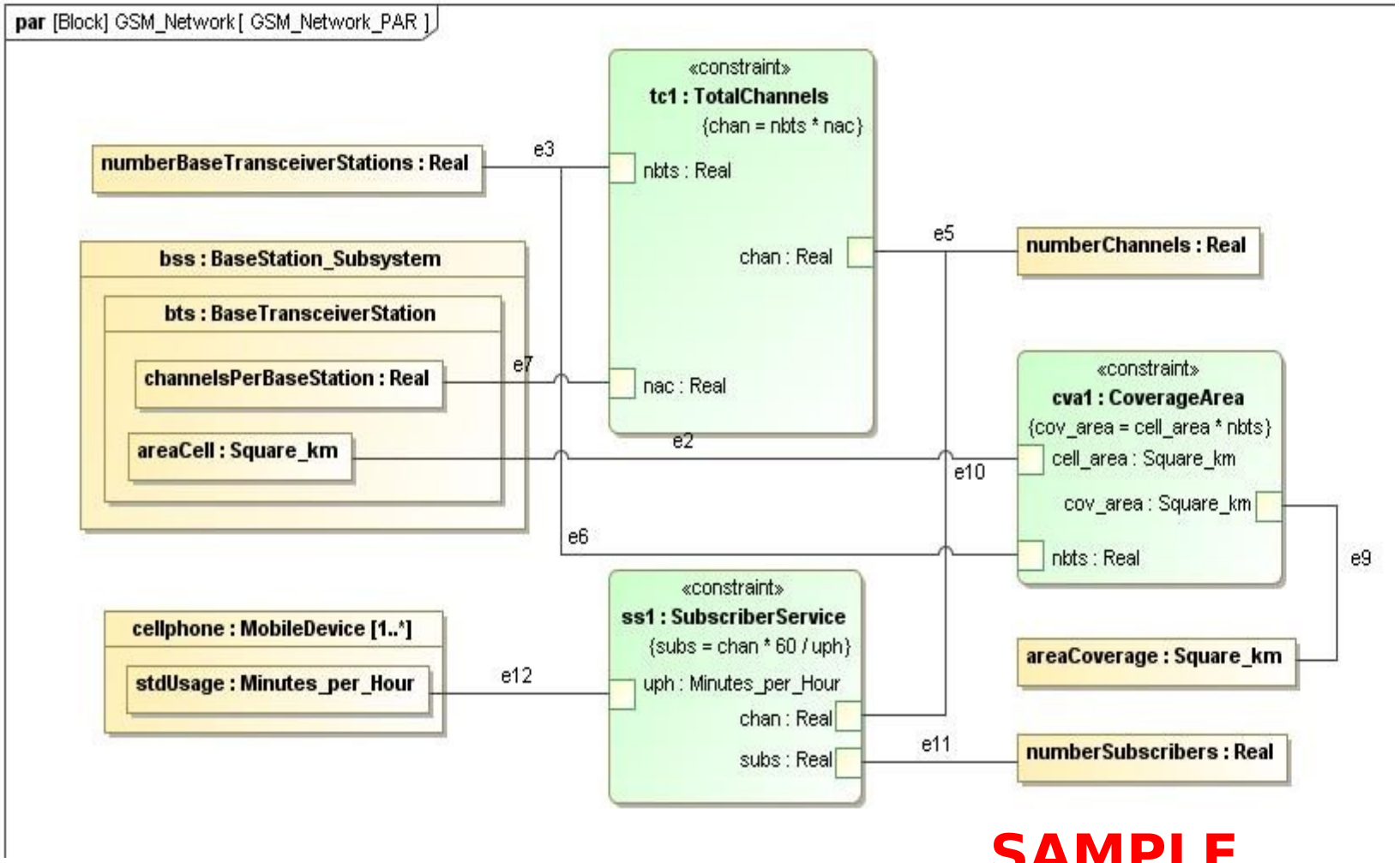
Mobile_Device_State



GSM_Network_BDD

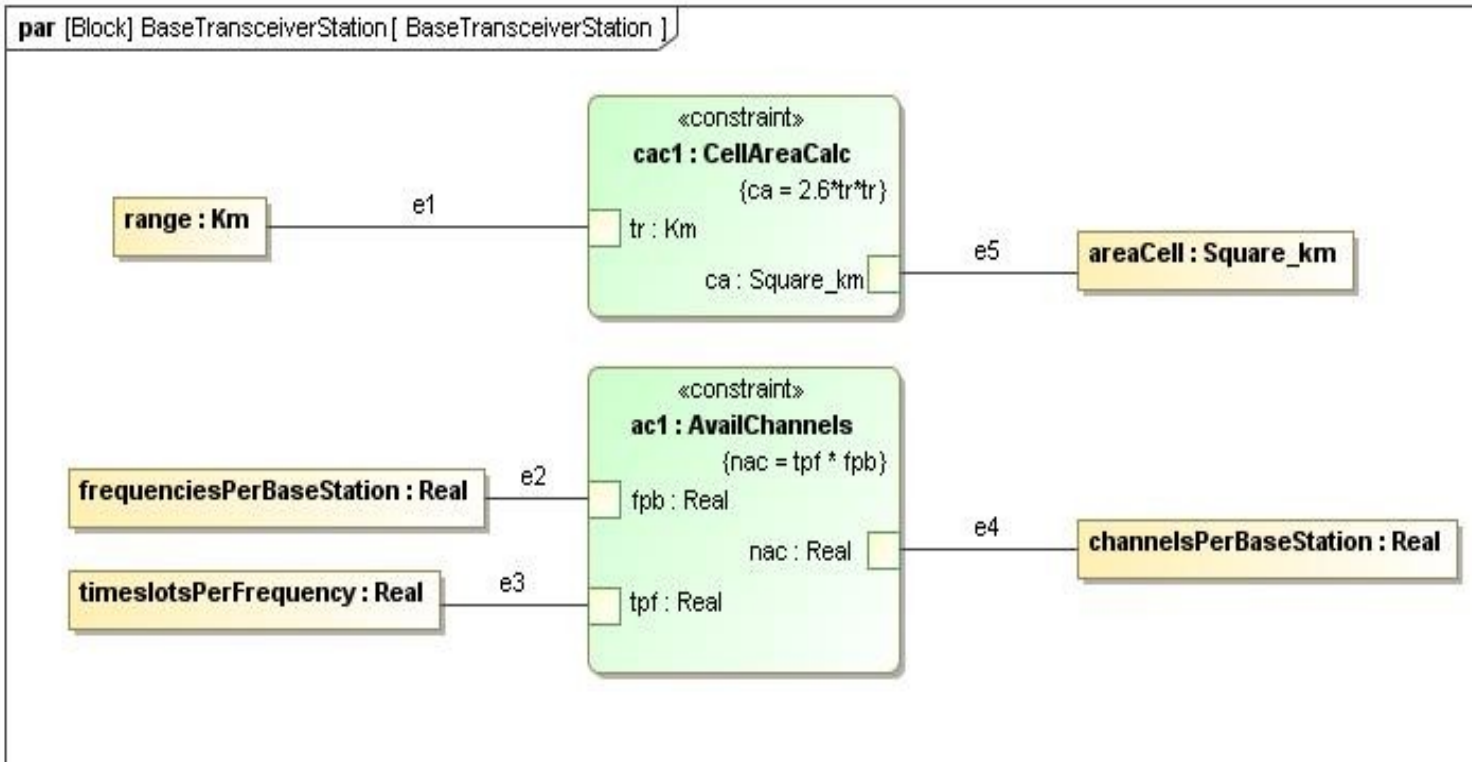


GSM Network - Parametric Diagram



SAMPLE

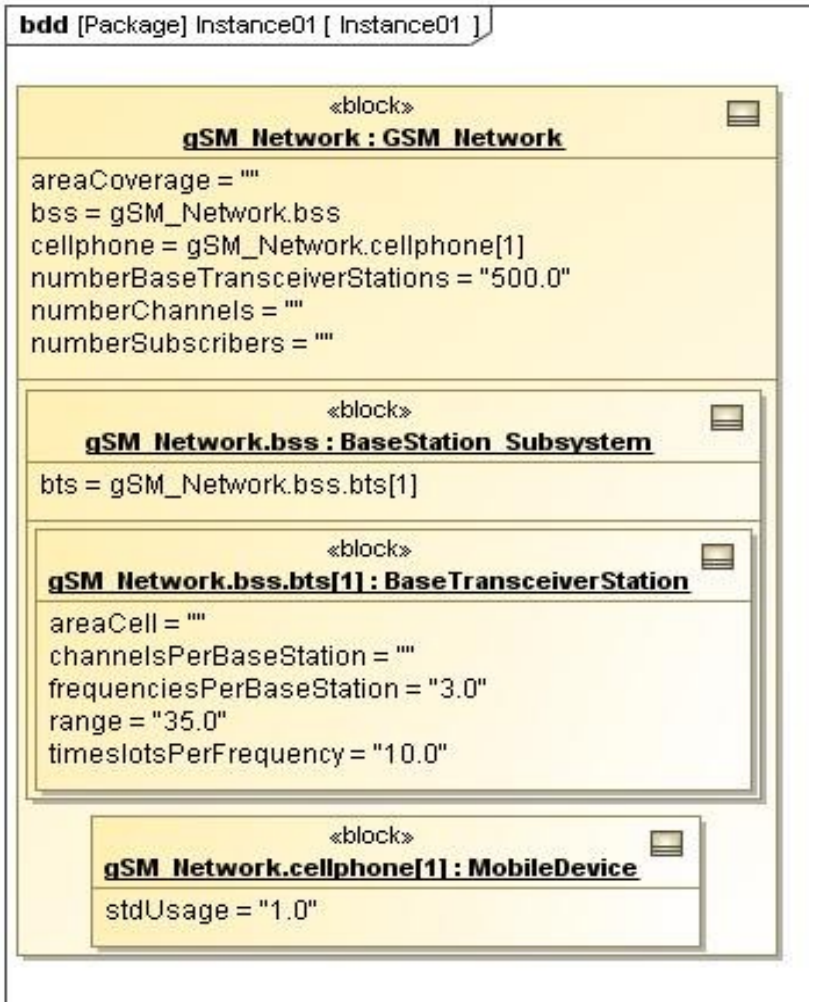
BaseTransceiverStation – Parametric



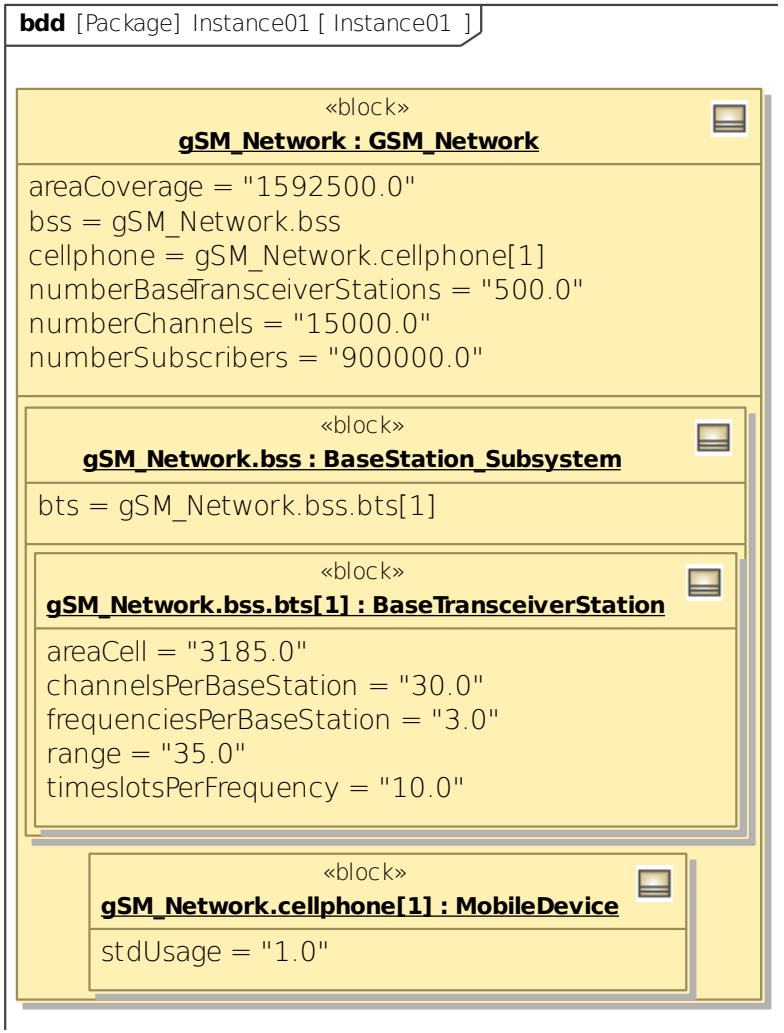
SAMPLE

Instances

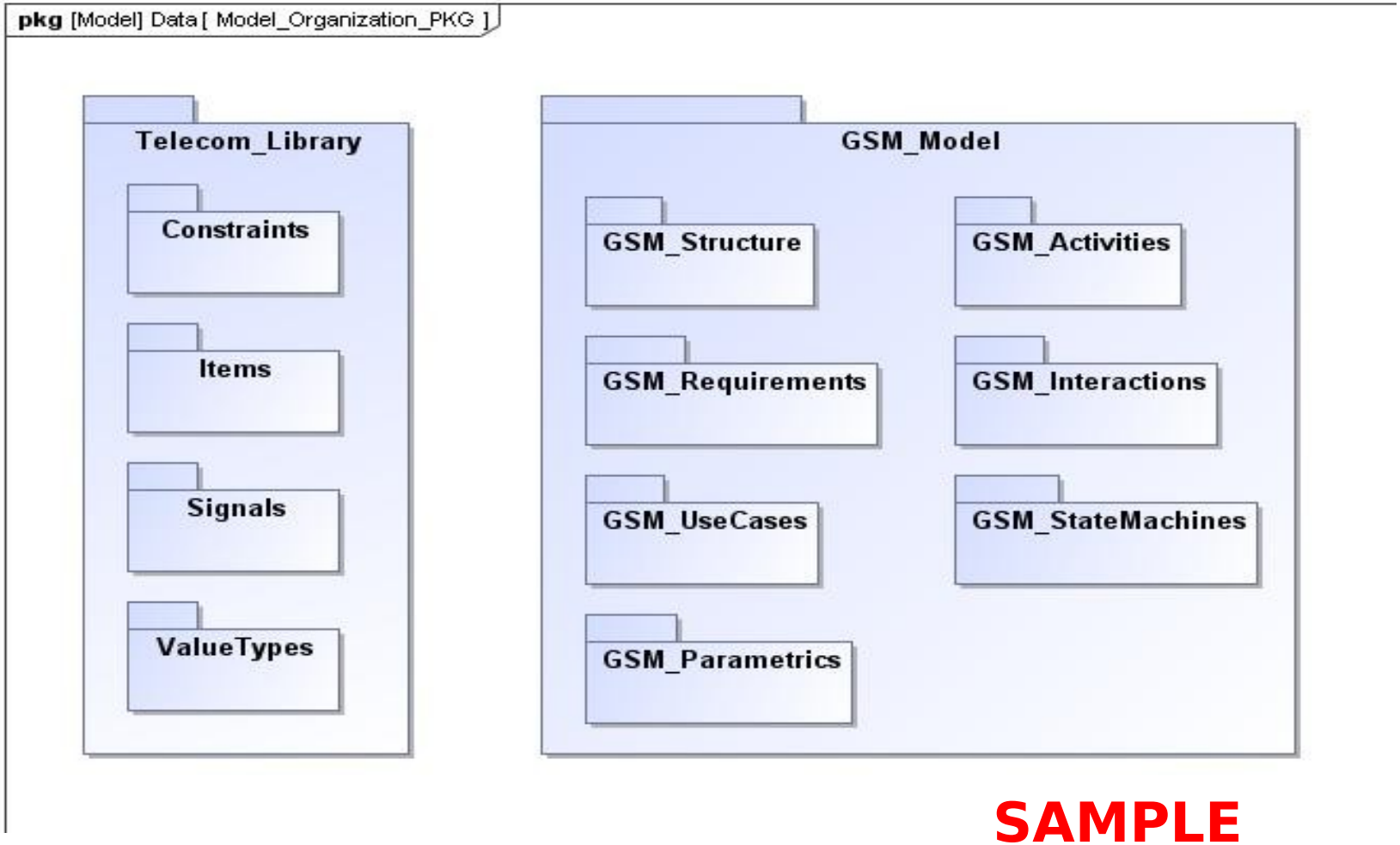
Before Solution SAMPLE



After Solution



Package Diagram



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